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DEPARTMENT OF THE INTERIOR, CANADA

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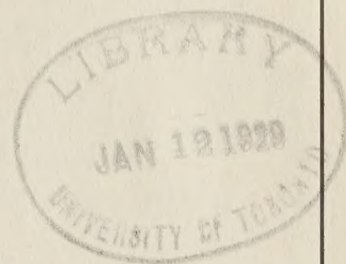
FOREST SERVICE

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THE
FORESTS OF CANADA

*Their Extent, Character, Ownership,
Management, Products, and
Probable Future*

(Revised for the Third British Empire Forestry Conference held in
Australia and New Zealand, August to October, 1928)



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THE FORESTS OF CANADA

1—General Description of Canada From a Forestry Viewpoint

The Dominion of Canada may be divided into three main regions, namely, the Cordilleran, Great Plains, and Eastern regions. In each of these regions there are distinctive vegetative belts, the character of which is determined by climatic or physiographic conditions. Within these belts there are numerous forest types which are largely the result of local soil and climatic conditions.

Cordilleran Region—

The Cordilleran region is characterized by numerous ranges of mountains running in a general northwesterly direction parallel to the Pacific Coast. These mountains, of which the Rocky mountains form the eastern and most prominent system, are called the Cordilleras in Canada. The Rocky mountains vary in elevation from 5,000 to 13,000 feet above sea-level, and many of the peaks exceed 11,000 feet. Between the Rocky mountains and the Pacific ocean are the Columbia system, comprising the Selkirk, Monashee, and Cariboo mountains; the Interior Plateau system, including the Fraser and Nechako plateaux; the Cassiar system, comprising the Stickine, Babine and other mountains; the Yukon system; the Pacific system, comprising the Cascade, Coast, Bulkley, and other mountains; and the Insular system, which is represented by the mountains on Vancouver island and the Queen Charlotte islands.

Between the principal mountain ranges there are broad, well drained U-shaped trenches, the chief of which are the Rocky Mountain, the Purcell, the Selkirk, and the Coastal trenches.

These valleys are of great strategic value from the standpoint of the exploitation of the forests, for not only do they contain the principal waterways, but they provide means of access by roads and railways to the vast interior resources in lands, mines, and forests. Several of the larger rivers, such as the Fraser, Skeena, and their tributaries, break through by connecting valleys from one trench to another, and supply shorter routes of communication between the intermontane trenches and the ocean ports.

The agricultural land, which comprises approximately six per cent of this region, is confined chiefly to the valley bottoms and alluvial deltas.

The Rocky mountains and the islands on the coast are formed chiefly of Palaeozoic rocks. The Coast range is almost entirely granitic in formation and the Selkirks are almost entirely pre-Cambrian or Cambrian. The intervening ranges are of mixed formations, varying from rocks of sedimentary origin to granites and volcanic intrusives.

Great Plains Region—

From a geological point of view the Great Plains are limited to an area lying south of the Canadian Shield of pre-Cambrian rocks, but as far as the forests, drainage, and general topography are concerned, the Great Plains region may be taken as including all of the vast interior basin, extending from the foot-hills of the Rocky mountains to the eastern boundary of Manitoba and north to the Arctic ocean. The principal rivers rise in the eastern slope of the Rockies, the Mackenzie flowing north into the Arctic ocean and the Nelson and Churchill into Hudson bay. There are no real mountains in this region, though the Cypress hills in Alberta rise 2,600 feet above the surrounding plain and the Riding and Duck mountains in Manitoba 1,000 to 1,600 feet. In general, this region slopes gradually from an elevation of about 3,000 feet at the base of the Rockies towards the north and east till it reaches tide-water.

From the mountains to lake Winnipeg, the underlying rock is of the Mesozoic and Tertiary periods. Over this is a deep layer of fertile soil, which makes the prairies of this region so productive for agriculture. North of this, in the vicinity of Great Slave lake, is an extensive area of Devonian rock. North of a line extending from the mouth of the Mackenzie river to lake Winnipeg and lake of the Woods, the geological formation is pre-Cambrian, chiefly Laurentian, being part of the great Canadian Shield, which stretches across Canada to the Labrador coast and extends south to an apex at the Thousand islands in the St. Lawrence river.

Eastern Region—

The Eastern region, which includes the provinces of Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island, drains either into Hudson bay on the north or into the Atlantic ocean. The St. Lawrence waterways system, of which the Great Lakes are a part, extends nearly half-way across the continent and drains the southern part of Ontario and Quebec.

Though there are no very high mountains in this region, the Laurentian Highlands of the Canadian Shield north of the St. Lawrence river have a general elevation of from 1,000 to 2,000 feet and a few peaks rise above 2,600 feet. A northern extension of the Appalachian system approaches the St. Lawrence below Quebec city and extends along the Gaspé peninsula, where peaks rising to 3,500 feet occur. The highlands of New Brunswick are also part of this system

of mountains. An additional range apparently forms the province of Nova Scotia, though in few places does the elevation exceed 1,500 feet. The St. Lawrence lowlands constitute a plain of low relief extending from a little below Quebec to Lake Huron. This is primarily an agricultural district.

South of the Canadian Shield, already referred to, a great variety of geological formations occur, but they are for the most part of the Palaeozoic period, ranging from Ordovician to Upper Carboniferous.

2—Main Types of Forest Growth

CORDILLERAN REGION

The Cordilleran region contains five belts in which the climatic conditions are so distinct as to produce forests of different characters. These are the Coast, Interior Dry, Interior Wet, Rocky Mountain, and Sub-Arctic belts.

COAST BELT

Along the coast of British Columbia to the west of the summit of the Cascade and Coast mountains, the climate is mild, equable, and humid. The mean annual temperature varies from 44° to 49° F., with a summer mean of 55° to 61° and a winter mean of 30° to 38°, according to latitude. The precipitation is the heaviest in Canada and varies from 40 to 120 inches, depending on the position of the minor ranges of the Coast mountains, which, by intercepting the west winds blowing from the Pacific, cause them to discharge the greater part of their moisture. The major part of this precipitation, however, does not fall during the growing season, but occurs during the fall and winter, only 30 per cent falling during the spring and summer. This is sometimes given as a reason for the prevalence of coniferous forests, the claim being made that broad-leaved trees require more moisture during the growing season. The coniferous trees in this region grow most luxuriantly, and the largest individual trees as well as the heaviest stands of timber in Canada are found in this belt.

Douglas Fir-Western Cedar Type—

In the southern portions of the Coast Belt, the Douglas fir-western cedar type generally extends from sea-level to 2,000 or 2,500 feet altitude. Towards the northern limit the altitudinal range decreases. Associated with the principal species are western hemlock, western white pine, and balsam fir (lowland fir and amabilis fir).

Western Cedar-Western Hemlock Type—

As the Douglas fir disappears from the stands towards the north or at higher altitudes, the forest changes to a red cedar-hemlock type with amabilis fir and yellow cypress as subsidiary species. This type descends to sea-level between Knight's inlet and Rivers inlet on the mainland and Barkley sound and Quatsino sound on Vancouver island. It has an altitudinal range of from 1,500 to 3,000 feet above sea-level.

Western Hemlock-Sitka Spruce Type—

The Western Hemlock—Sitka Spruce type is a lowland type prevalent in the northern portion of the Coast belt between Rivers inlet and Portland canal and especially on the Queen Charlotte islands. It also occurs on well-watered situations along valley bottoms within the range of the Douglas fir.

Western Hemlock-Balsam Fir Type—

Occupying a climatic zone somewhat less favourable than the red cedar-hemlock or the hemlock-Sitka spruce types, the hemlock-balsam fir type occurs either on higher or more exposed or wetter sites. It has an altitudinal range of from 1,500 to 3,500, or, in some situations, 4,000 feet. It is not present on the Queen Charlotte islands.

Sub-Alpine and Muskeg Type—

At higher elevations between the merchantable timber line and the absolute timber line there is a sub-alpine type of stunted tree growth, composed chiefly of mountain hemlock, yellow cypress, and alpine fir, with, occasionally, red cedar, lodgepole pine, or white-barked pine. A similar type is found on very wet or exposed situations at lower elevations along the coast.

Deciduous Type—

On the alluvial bottomlands of many of the larger valleys, stands of black cottonwood occur. It is associated with alder and broad-leaved maple. This is typically a pioneer type on newly formed land.

INTERIOR DRY BELT

The moisture in the prevailing west winds having been precipitated to a large extent on the western slope of the Coast and Cascade mountains, the southern part of the Interior plateau is of a semi-arid character and is known as the Interior Dry belt. This condition extends through

the valleys of the southern portion of the Monashee, Selkirk, and Rocky mountains to the Crowsnest pass. In this belt the annual precipitation varies from 10 to 20 inches, and the range of temperature extends from 100° to -45° F. This climate is naturally less favourable to tree growth, and open park-like stands are characteristic of this belt, especially at the lower altitudes. At higher elevations there is more moisture, and the stands become denser. In the northern part of the Interior plateau there is more moisture and lower temperature, resulting in denser stands of smaller trees somewhat similar to the northern forest belt on the Great Plains.

Treeless Type—

In the lower portions of the valleys in the southern part of the Interior Plateau, there is a treeless type characterized by a growth of sagebrush (*Artemisia tridentata*) in the driest situations in the bottoms of the valleys and by bunch grass (*Agropyron spicatum*) on the higher mountain sides and benches. The land is very fertile when irrigated and the bunch grass provides excellent grazing.

Yellow Pine Type—

Bordering on the grass lands, open park-like stands of western yellow pine occur, becoming denser as the elevation and moisture increase until fairly dense stands develop. This type usually occurs at altitudes between 1,500 and 2,500 feet above sea-level, but may extend to 3,000 feet on southern exposures.

Interior Douglas Fir Type—

As the altitude increases, Douglas fir gradually becomes more prominent in the yellow pine type until it becomes predominant. It extends to elevations of 3,500 to 4,500 feet. The Douglas fir of the Interior differs markedly from that of the Coast Belt. It is smaller, shorter-boled, and more limby, and is much harder when subjected to extreme climatic conditions.

Douglas Fir-Western Larch Type—

In the southeastern part of the Interior Dry belt, this type covers a limited area usually between the yellow pine and Douglas fir types. Forest fires have played an important part in the formation of this type, since the thick bark of the larch makes it more resistant to fire than the concomitant species.

Engelmann Spruce Type—

At the upper altitudinal and latitudinal limits of the Douglas fir type, the Engelmann spruce type develops. This type merges into a spruce-alpine fir type and finally the sub-alpine type.

Lodgepole Pine Type—

As a result of repeated fires, lodgepole pine has replaced the original forests to a very considerable extent in the Douglas fir and Engelmann spruce types, and has also encroached on the yellow pine type. The transformation has been so extensive and so complete that lodgepole pine must be considered as an established type from a managerial aspect. In many places reproduction of Douglas fir and Engelmann spruce is present under the lodgepole pine, giving promise, if afforded protection from fire, of the final reversion to the climax type.

INTERIOR WET BELT

After crossing the plateaux, the westerly winds from the Pacific ocean strike the higher mountain ranges which lie to the east, and, being compelled to ascend their western slopes, a precipitation takes place which is much greater than that of the Dry belt, and, as a result, types of forest which resemble those in the Coast belt are produced. This belt includes the Monashee, Cariboo, and Selkirk mountains and the Rocky Mountain trench from the Canadian Pacific railway north to the headwaters of the Parsnip river. In this belt the average precipitation is over 30 inches and in some places as high as 60 inches, a large proportion at the higher altitudes being in the form of snow. Extremes of temperature recorded vary from 100°F. in summer to -17°F. in winter. The mean daily temperature is about 44°F.

The distribution of the forest types is determined primarily by altitude and latitude.

Interior Western Cedar Type—

The increased precipitation in this belt has resulted in the development of forest types similar to those found on the Coast. In the wetter situations in the valleys, red cedar becomes the predominating species. In the southern portion of the belt it is associated with Douglas fir, Engelmann spruce, western white pine, hemlock, larch, lowland fir, alpine fir, and cottonwood. Farther north, alpine fir and Engelmann spruce become more prominent and the other species drop out of the type.

Western Cedar-Hemlock Type—

On the benches and lower slopes of the valleys in the southern portion of the Interior Wet belt, red cedar and hemlock are the principal species. The altitudinal range of this type is between 3,000 and 4,000 feet.

Western Cedar-Engelmann Spruce Type—

Engelmann spruce replaces the hemlock at higher elevations; finally the cedar is eliminated and the Engelmann spruce-alpine fir type extends to the limit of commercial tree growth.

ROCKY MOUNTAIN BELT

In that part of the Rocky mountains not included in the Interior Dry belt, the climatic conditions are extremely variable, depending mainly on altitudinal and latitudinal variations but also on the exposure, western and southern slopes being warmer than eastern and northern. A considerable proportion of the area is above merchantable timber-line, but the lower slopes and valleys are, as a rule, densely forested with trees of relatively small size.

The forests of the Rocky mountains present a varied character. On the southern portion of the Rocky Mountain trench, typical dry-belt conditions exist and the yellow pine type extends as far north as the Kootenay river. North of this the Douglas fir type extends to Golden, and beyond this, to the junction of Bear and Fraser rivers, the western cedar types of the Interior Wet belt occur.

Engelmann Spruce-Lodgepole Pine Type—

Excluding those portions belonging ecologically to the Interior Dry and Wet belts, the climax forest of the Rocky Mountain belt predominantly is Engelmann spruce, with an increasing proportion of alpine fir at higher altitudes. Lodgepole pine is always found in admixture with Engelmann spruce.

This type has suffered so severely from fire, especially on the drier eastern slopes, that lodgepole pine has become established over large areas in many places, to the practical exclusion of the original species. In others the spruce will eventually gain supremacy.

SUB-ARCTIC BELT

In the Yukon plateau and the extreme northern part of the Rocky Mountain system north of latitude 58 degrees north, the general elevation is over 4,000 feet above sea-level, the climate is severe, the growing season short, and precipitation scant. As a result, forests develop only on the more favourable sites in the valleys, and grow very slowly. The trees are small and of poor quality, but, though of little commercial value, the wood is of very great value to the mining industry and to the trappers.

Forest Types—

The principal forest type in this belt is the white spruce-alpine fir. The lodgepole pine type occurs on the poorer soils, where the original forest has been badly burned. Poplar groves and willow thickets occupy the richer soils where the coniferous forest has been completely destroyed by fire.

GREAT PLAINS REGION

There are four vegetative belts in this region, namely, the prairie, northern forest, sub-arctic, and arctic.

PRAIRIE BELT

In the southern portions of Alberta, Saskatchewan, and Manitoba there is a large area—about 105,000 square miles—which is practically treeless, and in its natural state was a huge grass-covered plain, mostly flat, but in some localities gently rolling. Deep valleys have been cut by some of the larger rivers. These prairies extend about 350 miles north from the International Boundary along the foot-hills of the Rockies and taper to a point near the southeast corner of Manitoba. Prairie conditions extend through the adjoining states—North Dakota and Montana—and southward. The occurrence of scattered patches of tree growth adjacent to natural fire-breaks, such as streams, lakes, and hills, would indicate that fires have been responsible to a large extent for the absence of forests in this area. Aspen is the most prevalent species in the natural “bluffs” (as these patches of trees are called), but white spruce and jack pine are found in some places. With the extension of settlement and the control of the prairie fires the natural groves of trees have greatly increased in number and size, and, as a result of the assistance given by the Dominion Government, many thousands of plantations have been established on the farms, so that the unbroken prairie landscape has been altered to a considerable extent. The soil is generally composed of a deep layer of rich clay, which is of high agricultural value. The climate is severe in winter but warm in summer, with long hours of sunlight, which is conducive to rapid growth. The amount of precipitation varies from 13 inches to over 20 inches, being less in the southwest portion of the belt. The winter climate in Alberta is tempered by the warm, dry wind known as the “Chinook,” which blows from the southwest.

NORTHERN FOREST BELT

North of the prairie there is a forest belt from 300 to 400 miles wide with an intervening transition zone partly prairie and partly forest. In the latter there is considerable agricultural land, but in the Northern Forest belt proper, there is comparatively little land suitable for agricultural development. The northeastern part of this belt is underlain by the pre-Cambrian rocks of the Canadian Shield, which are usually very close to the surface, if not exposed. The impervious rocks obstruct the drainage, and numerous lakes, swamps, and open muskegs are formed. On the whole, the forests are of secondary commercial importance, having been severely damaged by fire, but wherever the soil conditions are suitable the growth is rapid and the protection now being provided against fire is resulting in the steady improvement of the forests. Black spruce, white spruce, jack pine, larch, balsam fir, aspen, and white birch are the predominating species in this belt. This same belt extends across northern Ontario and Quebec to Labrador.

White Spruce Type—

From a commercial standpoint, the most important type in these forests is the white spruce type. Though it has been decimated by fire, most of the logging operations are conducted in this type. Under natural conditions it occupies the heavier, well drained soils. Balsam fir is frequently associated with white spruce, especially in the eastern portion of the belt.

Black Spruce Type—

Black spruce, either pure or associated with tamarack (eastern larch), is found on poorly drained lands which comprise a considerable portion of the area.

Jack Pine Type—

Like the lodgepole pine, to which it is closely related, jack pine has gained ascendance over the spruce through the agency of fire. In some situations, especially on the lighter soils, it has formed a permanent managerial type, but on others it may be considered a temporary type.

Intolerant Hardwood Type—

So severely have the coniferous forests suffered from fire that aspen has become the prevalent species throughout the Northern Forest belt. Though it will eventually be replaced by conifers where there is a possibility of securing reproduction of these species, over vast areas there is no immediate prospect of securing a coniferous forest by natural agencies. In the eastern portion of the belt, white birch is frequently associated with the aspen, and on moist situations, such as along streams, balsam poplar occurs.

SUB-ARCTIC BELT

The forests gradually diminish towards the north, giving place, except along the water-courses, to the sub-Arctic "tundra," a region of bogs and bare glacier-worn rocks of the Canadian Shield. The occurrence of spruce trees 12 to 16 inches in diameter, even as far north as McPherson (Lat. 67° 25' N.) indicates that soil conditions, and perhaps fire, have had more influence than climatic conditions in the limitation of the forests. What timber there is in this belt is valuable for the protection of game and the use of the local inhabitants. This belt also extends across Ontario and Quebec. Black and white spruce, jack pine, larch, aspen, and white birch persist in this northern belt.

ARCTIC BELT

The extreme northeastern portion of the Great Plains region is treeless. The northern limit of tree growth may be roughly indicated by a line drawn from the mouth of the Mackenzie river on the Arctic ocean to the mouth of the Churchill river at Hudson bay, and across the Labrador peninsula at about latitude 58° N.

EASTERN REGION

The forests of the eastern region are more diversified than those of the Great Plains and several belts with distinct characteristics are recognized, namely, the Carolinian, Tolerant Hardwood, Acadian, Mixed Hardwood-Softwood, Transition, Northern, and Sub-Arctic belts.

CAROLINIAN BELT

This belt is the northern extremity of a similar zone in the United States. It is confined to the southwestern portion of Ontario bordering on lake Erie and the western end of lake Ontario. It is characterized by several species of broad-leaved trees seldom or never found elsewhere in Canada. These are the tulip tree (*Liriodendron Tulipifera*), sycamore (*Platanus occidentalis*), sassafras (*Sassafras variifolium*), chestnut (*Castanea dentata*), black gum (*Nyssa silvatica*), papaw (*Asimina triloba*), and black walnut (*Juglans nigra*).

Agriculture, including fruit-growing and tobacco culture, is highly developed in this district and the remaining forests are in farmers' woodlots. The climate is very mild, the mean temperature being about 45°F. and the annual precipitation from 30 to 40 inches.

TOLERANT HARDWOOD BELT

North of the Carolinian belt and from the southern end of Georgian bay to the Eastern Townships in Quebec, the forests are composed primarily of such hardwoods as maple, elm, beech, basswood, ash, yellow birch, oak, hickory, and butternut, which are classed as tolerant on account of their shade-enduring abilities as compared with poplar and white birch, the light-demanding broad-leaved species.

Coniferous types composed of red and white pine, spruce, balsam fir, cedar, and larch frequently occur within this belt and also in the Carolinian belt, but they are usually confined to swampy or light soils. This hardwood belt is almost entirely underlain by Devonian, Silurian, and Ordovician rocks of the Palaeozoic Age, and, as the soil is of high agricultural value, only remnants of the original forests are now found in farmers' woodlots.

In this belt the mean temperature is somewhat lower, 40 to 45°F., and the annual precipitation is 33 to 43 inches.

ACADIAN BELT

In the Maritime Provinces and the Gaspé peninsula of Quebec, the forests are primarily coniferous and are characterized by the prevalence of red spruce. Other conifers such as white and black spruce, balsam fir, white cedar, white, red and jack pine, hemlock, and larch, and the hardier hardwoods are also found in this belt. The geological formation is almost entirely of the Palaeozoic Age. The surface is, for the most part, broken and irregular, and there is good drainage, so that there are few lakes. There is good agricultural soil in many places, but over two-thirds of the land area is still under forest and about one-half is essentially forest land.

The proximity of the Atlantic ocean causes the climate to be cool and moist. The mean daily temperature is between 40 and 44° F., and the annual precipitation from 40 to 50 inches, less than one-quarter of which is in the form of snow. Both soil and climate are conducive to the reproduction and rapid growth of coniferous forests.

MIXED HARDWOOD-SOFTWOOD BELT

Adjoining the hardwood belt in Ontario and Quebec there is a zone in which the tolerant hardwoods and softwoods associate. The northern limit of this belt extends roughly from the northeast corner of lake Superior to the mouth of the Saguenay river on the St. Lawrence. It is underlain by pre-Cambrian rocks, and the area which can be successfully developed for agriculture is limited. The surface is rolling, and numerous lakes and rivers occur. The climate is a little more severe and the precipitation slightly less than in the hardwood belt.

It is in this belt the white pine reaches its maximum development, and though, since the beginning of the lumber industry in Canada, it has been subjected to most extensive exploitation, it still occupies an important position in forest production in eastern Canada. The character of the forests has been greatly altered by cutting and fire, the valuable red and white pines having been replaced to a large extent by spruce, balsam fir, jack pine, and hardwoods. This belt contains a large number of species, comprising several forest types which are determined primarily by soil conditions.

Pine Type—

Red pine is frequently, but not always, associated with white pine in this type. On light soils pure stands of pine occur, but on heavier soils there is usually an admixture of shade-tolerant species, such as spruce and hemlock, and yellow birch, maple, beech, and other hardwoods which occupy a minor position in the stand. The exclusive cutting of pine, which until recently has been generally practised in these forests, has resulted in the displacement of the pine by the concomitant species.

Tolerant Hardwood Type—

Almost pure stands of hardwood composed of maple, yellow birch, elm, ash, basswood, beech, etc., are becoming more widely established. Under undisturbed conditions "hardwood ridges" carrying chiefly maple and yellow birch occur throughout this belt.

White Spruce-Balsam Fir Type—

This type, though common in the virgin forests, has become more frequent since the removal of the pine and on account of its value as pulpwood is now the most valuable type in this belt.

Black Spruce Type—

Black spruce, usually associated with tamarack and white cedar, forms the typical stands of the swamps and low ground.

Jack Pine Type—

Fire has resulted in the establishment of jack pine over very considerable areas in this belt. In some cases it is only a temporary type, but in others it has taken almost complete possession, especially on light sandy or gravelly soils. The value of jack pine for railway ties and pulpwood and the ease with which it can be grown render it a not undesirable species to perpetuate.

Intolerant Hardwood Type—

Aspen and white birch comprise a widely distributed fire type, which is for the most part temporary in character, since coniferous reproduction is generally present and will eventually dominate these short-lived species.

TRANSITION BELT

Between the northern limit of the tolerant hardwoods and the height of land separating the St. Lawrence and the Hudson Bay drainage areas, and including the Lake of the Woods drainage area in western Ontario, there is a belt in which the conifers typical of the Mixed Hardwood-Softwood belt (white pine, red pine, white spruce, and balsam fir) are prevalent, but the tolerant hardwoods (maple, yellow birch, etc.) are absent. Jack pine and the intolerant hardwoods (aspen and white birch) are prominent on old burns, and black spruce and tamarack occupy the swamps. This belt lies on the Canadian Shield, and the configuration is similar to the land to the south. There is comparatively little land of agricultural value. The climate is more severe, the mean temperature being between 35 and 40° F., and the precipitation 23 to 30 inches.

NORTHERN FOREST BELT

On the Hudson Bay drainage, the forests change to the northern forest types similar to those in the Great Plains region. Though white pine and red pine do occur for some distances north, they are relatively unimportant from a commercial point of view. Black spruce becomes more prevalent owing to the extensive areas of poorly drained lands. Jack pine is plentiful on the higher and drier sites, and the aspen-white birch type is widely distributed. The pre-Cambrian rocks underlie this belt, and there are several large areas covered with clay which are now being successfully developed for agriculture. The greater part of the belt is still under forest, however, and most of it is suitable only for forestry. The climate is more severe and the tree growth slower than south of the height of land.

SUB-ARCTIC BELT

For approximately 100 miles south of Hudson bay the forests are of the sub-Arctic type and are confined, for the most part, to the better-drained sites along the rivers. Though the climate is severe, lack of adequate drainage is the principal factor in limiting the development of the forests.

3—Area and Contents of Existing Forests

The areas of agricultural and forest land can only be estimated, since systematic land classification has been attempted on only limited areas and, for a large part of the Dominion, there is very little definite information regarding either the agricultural or the forest resources.

The total area of Canada is now given as 3,684,721 square miles, since, by the decision of the Privy Council in 1927, 112,400 square miles formerly included in Quebec was granted to Newfoundland. The area covered by known lakes and rivers is 137,491 square miles, leaving a land area of 3,547,230 square miles.

The area suitable for agriculture, including grazing, is estimated to be 483,950 square miles, of which at the time of the last census, 1921, only 220,134 square miles was occupied and in 1925 only 91,000 square miles was under field crops. About 82,260 square miles of agricultural land is still forested, and at least 30,000 square miles should, and undoubtedly will, be kept in farmers' woodlots. The remaining 52,260 square miles will likely be cleared in time, but at present is growing wood.

The total forest area, including the 82,260 square miles of forest on agricultural land, is estimated to be 1,151,454 square miles, and of this about 1,100,000 square miles is essentially forest land which can be utilized to the best advantage under forest. Under the present conditions of transportation, prices of forest products, and manufacturing conditions, it is estimated that the forests on 285,574 square miles are inaccessible or unprofitable to operate. With the extension of railways, improvements of waterways, development of new and more efficient methods and equipment for logging, and the ever-increasing demand for wood, the exploitable limits are constantly being extended, and it would be unwise to set any definite limitation on the area which will eventually be utilizable. On 311,234 square miles the timber is so located as to be commercially exploitable, and is of sufficient size, and on 554,646 square miles there is accessible young growth, which, if protected from fire, will produce merchantable timber. The virgin forests on these lands, as well as on part of the land now carrying merchantable timber, has either been destroyed by fire or cut for use, chiefly the former. There are, therefore, 865,880 square miles of productive forest, of which less than 200,000 square miles are mature, and the remainder is in a growing condition.

It is difficult to classify the area as to whether it carries coniferous or broad-leaved species, since, where broad-leaved species occur, they are usually mixed with conifers and very little of the area is naturally of the purely broad-leaved type. (See Sec. 2).

The mixed types are of two kinds, namely, the virgin, such as is found in the mixed hardwood-softwood belt, and the temporary poplar-whitebirch-conifer type which is so prevalent throughout the northern forest belt as the result of fires and cutting. In the early stages of this latter type, the stand may be almost purely broad-leaved, but ultimately the conifers tend to predominate. In the table hereunder the distinction has been based on the present predominance of broad-leaved or coniferous species. It must be pointed out, however, that figures are based on general observations and not on accurate surveys.

It is felt that it is advisable to separate the accessible and productive area into two classes, namely, that carrying timber of merchantable size, and that carrying young growth.

TABLE 1—STATEMENT SHOWING THE TOTAL AREA OF FOREST, AGRICULTURAL, AND OTHER LAND, AND THE PERCENTAGE OF THE LAND AREA COVERED BY FOREST

—	Forest				Agricul- tural land (a)	Other land	Total land
	Accessible		Unprofit- able or inaccessible	Total			
	Merchant- able	Young growth					
	(1a) Square miles	(1b.) Square miles	(2) Square miles	(3) Square miles	(4) Square miles	(5) Square miles	(6) Square miles
Conifers.....	280,000	440,000	240,000	960,000	.....	.....	.....
Broad-leaved.....	31,234	114,646	45,574	191,454	.....	.....	.....
Total.....	311,234	554,646	285,574	1,151,454	483,950	1,994,085	3,547,230
Forest Area in Percentage of Total Land Area.....	8.8	15.6	8.1	32.5			

(a) Agricultural land includes 82,259 square miles of forested land, included also in 1a and 1b, and of this area 30,000 square miles should remain permanently in woodlots.

VOLUME OF STANDING TIMBER

In 1923, the total stand of timber in Canada was estimated to be approximately 246,792 million cubic feet, of which 198,410 million cubic feet was of coniferous species and 48,382 million cubic feet of broad-leaved species.

During the years 1922-1926, the average annual depletion due to use was 1,860 million cubic feet of conifers, and 848 million cubic feet of hardwoods. The loss from fire is estimated at 730 million cubic feet of conifers and 170 million cubic feet of hardwoods. Though no very wide-spread epidemics of insects or fungous diseases have occurred, the spruce bud-worm and various bark-beetles have been active in some localities, and there is a constant loss through decay. In the absence of any basic data on which to estimate the losses from these causes, they have been taken to nearly equal that from fire—perhaps 800 million cubic feet. The total depletion during the five years is therefore estimated to have been approximately 22,000 million cubic feet.

To what extent this has been replaced by increment, no one knows, but considering the preponderance of the younger age-classes in the reproduction, it is felt that there has been a considerable net depletion in merchantable timber, amounting to perhaps 9,000 million cubic feet. Additional data secured by the Royal Commission on Pulpwood account for the balance of the reduction.

The estimate of the total stand has been revised on this basis, and is given in tables IA, IB, and Ic. It must be borne in mind, however, that on a large proportion of the forest land in Canada no comprehensive stock-taking surveys have been conducted, and the figures have been compiled from estimates supplied by the various forest authorities and are subject to revision as more accurate information is secured.

It is still more difficult to divide the stand into merchantable timber and that which is inaccessible or unprofitable, since merchantability depends not only on the location, but on the density of the stand, the demands of the market for certain species or qualities of product, and the regulations governing cutting. Light stands covering large areas may in the aggregate carry very large amounts of timber and still not be exploitable at a profit. For some species, such as aspen and white birch, which comprise three-quarters of the hardwoods, there is very little demand, and, therefore, these cannot properly be classed as merchantable, though accessible as far as location is concerned.

Under present conditions it is doubtful whether more than 100,000,000,000 cubic feet of conifers and 15,000,000,000 cubic feet of hardwoods can be considered as merchantable.

TABLE IA—VOLUME OF STANDING TIMBER

	Merchantable		Unprofitable or Inaccessible		Total
	Per sq. mile	Total	Per sq. mile	Total	
	(1)	(2)	(3)	(4)	(5)
	Cu ft.	Million cu. ft.	Cu. ft.	Million cu. ft.	Million cu. ft.
Conifers.....	357,143	100,000	133,768	77,362	177,362
Broad-leaved.....	480,214	15,000	199,365	31,942	46,942
Total.....	369,497	115,000	141,991	119,304	224,304

TABLE IB—ESTIMATE OF THE TOTAL STAND OF TIMBER OF MERCHANTABLE SIZE IN CANADA, BY SPECIES

	Saw material	Small material	Total equivalent in standing timber
	Million feet board measure	1,000 cords	Million cu. ft.
Conifers—			
Spruce.....	98,174	341,880	61,500
Jack Pine.....	17,351	215,385	29,000
Balsam Fir.....	36,530	136,752	24,000
Cedar.....	78,411	33,633	21,107
Hemlock.....	53,425	8,975	12,750
Douglas Fir.....	68,886	3,205	15,461
White Pine.....	15,183	37,803	7,784
Red Pine.....	3,690	13,748	2,416
Larch.....	3,146	5,957	1,386
Yellow Cypress.....	4,000	1,000	993
Western Yellow Pine.....	3,881	983	965
Total.....	382,677	799,321	177,362
Broad-leaved—			
Poplar.....	15,981	226,436	30,000
White Birch.....	5,342	47,256	6,699
Yellow Birch.....	9,817	21,367	4,650
Maple.....	5,818	15,639	3,104
Beech.....	1,772	5,150	990
Basswood.....	964	2,495	503
Elm.....	798	1,975	406
Ash.....	521	1,781	322
Cottonwood.....	776		170
Oak.....	171	472	93
Red Alder.....		41	5
Total.....	41,960	322,672	46,942
Grand Total.....	424,637	1,121,993	224,304

TABLE IC—ESTIMATE OF TOTAL STAND OF TIMBER OF MERCHANTABLE SIZE IN CANADA BY REGIONS

	Conifers			Broad-leaved			Total		
	Saw material	Small material	Total equivalent in standing timber	Saw material	Small material	Total equivalent in standing timber	Saw material	Small material	Total equivalent in standing timber
	Million feet board measure	1,000 cords	Million cubic feet	Million feet board measure	1,000 cords	Million cubic feet	Million feet board measure	1,000 cords	Million cubic feet
Eastern Provinces.....	45,193	476,322	65,622	31,845	160,995	25,811	77,038	637,317	91,473
Prairie Provinces.....	17,484	275,564	36,070	9,338	159,921	20,756	26,822	435,485	56,826
British Columbia.....	320,000	47,435	75,630	777	1,756	375	320,777	49,191	76,005
Total.....	382,677	799,321	177,362	41,960	322,672	46,942	424,637	1,121,993	224,304

4—Important Timbers and Other Forest Products

The principal forest products of Canada are sawn lumber, lath, shingles, and pulpwood, and the species or groups of species described below are arranged in order of their importance as the sources of these products. Other important products are fuel-wood, railway ties, poles, piles, mine timbers, fencing material, wood for distillation, tan-bark, maple sugar, and syrup. Other minor products are Canada balsam, spruce gum, and nuts.

There are approximately 160 arborescent species of hardwoods and 31 coniferous softwoods in Canada, but of these only 23 species of softwoods and 32 species of hardwoods can be considered as commercially important. The conifers form over 80 per cent of the standing timber and 95 per cent of the lumber and pulpwood produced. The hardwoods are chiefly used for fuel, but they also furnish considerable lumber for flooring, interior finish, cooperage, turnery, and other wood-working industries.

Spruce.—Spruce is found in all the forest regions of Canada. Not only is it the most abundant wood, but it is also the principal wood used in the manufacture of pulp, and is second only to Douglas fir in lumber production. There are five indigenous species, all of which are commercially valuable.

WHITE SPRUCE (*Picea canadensis*) occurs in every province and extends to the northern limit of tree growth. The wood is light in colour and weight, straight-grained, and comparatively soft, and is an excellent material for general light-construction purposes. It is to a large extent taking the place of white pine. It possesses long, tough, easily bleached fibre which renders it especially valuable for the manufacture of paper.

RED SPRUCE (*Picea rubra*) is confined to the Maritime Provinces and the southeastern portion of Quebec. It is similar in general characteristics and uses to the white spruce, but the wood is somewhat darker in colour, finer in grain, and stronger.

SITKA SPRUCE (*Picea sitchensis*) is confined to low altitudes in the Pacific Coast belt. It is a very large tree, frequently reaching six feet in diameter. The wood is light and strong, and is considered the best wood in the world for the manufacture of aircraft. It is also an excellent pulp material.

ENGELMANN SPRUCE (*Picea Engelmanni*) is found in the interior portions of the Cordilleran region. It grows to a larger size than white or red spruce, but not so large as Sitka spruce. The wood is similar to white spruce. It is a valuable source of lumber, but has not yet been used extensively for pulpwood owing to the lack of development of the pulp and paper industry in the region which it occupies.

BLACK SPRUCE (*Picea mariana*) is a smaller species, usually confined to poorly drained sites. It is widely distributed and extends to the far north. Though occasionally used for lumber, it is especially valuable for pulpwood, as it makes an excellent grade of paper.

Pine.—There are eight species of pine in Canada, but only five are of commercial importance.

WHITE PINE (*Pinus Strobus*) is the eastern species of white pine. The commercial stands occur in the Lake of the Woods and the St. Lawrence drainage areas and in the Maritime Provinces. It was at one time the principal lumber species in Canada, but the supply has become so depleted that spruce and Douglas fir have surpassed it in quantity production. It is the most valuable softwood in Canada, and is exceeded in average value only by walnut, chestnut, and oak.

The wood is light in colour, strong in relation to its light weight, straight-grained, soft, and very fine and even in texture. It is especially noted for the ease with which it can be worked and for the fact that, when properly seasoned, it swells and shrinks very little when subject to changes of humidity. It is highly prized for building construction, interior finish, pattern-making and cabinet-work, but is not used for pulp. The trees attain a height of from 100 to 150 feet and a diameter of 3 to 4 feet.

WESTERN WHITE PINE (*Pinus monticola*) resembles in its general characteristics and uses the white pine of the east. It is confined to the more humid situations in the Coast and Interior Wet belts in British Columbia. It seldom forms a high proportion of the stand and the available supply is limited, so that it is not of such commercial importance as the eastern species.

RED PINE (*Pinus resinosa*) is often known as "Norway pine". It is found throughout the same region as white pine in eastern Canada and is frequently associated with it, though it does occur in pure stands. It is a hardier tree and has a somewhat wider range, and is in favour for reforestation on certain sites. It does not attain such large sizes as white pine, and the wood is heavier, harder, and more resinous, but it is used for the same purposes.

WESTERN YELLOW PINE (*Pinus ponderosa*) is confined to the Interior Dry Belt in British Columbia, where it grows in open park-like stands. The wood is intermediate in quality between white pine and red pine, and is used chiefly for light construction and interior finish. Mature trees are usually 18 to 40 inches in diameter and 60 to 100 feet in height. Though limited in distribution, it is an important source of lumber.

JACK PINE (*Pinus Banksiana*) is widely distributed throughout the forests of Canada from the Rocky mountains to the Atlantic. It is a small tree, seldom over two feet in diameter, but on account of its habit of growing in dense stands, it is usually tall and straight. It is very hardy and its wonderful reproductive power and the ability of cones to withstand a severe fire without injury to the seed have enabled it to replace the originally dominant species on large areas of burned-over land.

The wood is coarse, hard, and not very strong as compared with the other pines, and though sawn to some extent for lumber, its chief use is for railway ties, mine props, and poles, for which purposes it is especially adapted. It is also used to a considerable extent in the manufacture of kraft paper, and, with improvement in the other processes of making pulp, its use as pulpwood promises to be greatly increased. Though formerly considered a forest weed, it is becoming one of the most important species silviculturally and industrially.

LODGEPOLE PINE (*Pinus Murrayana*) is the western species of jack pine occurring throughout British Columbia and on the east slopes of the Rockies in Alberta. Its characteristics of growth, quality of wood, and uses are almost identical with those of jack pine.

Douglas Fir.—Douglas fir (*Pseudotsuga taxifolia*) is the only species of its genus represented in Canadian forests. It is confined to the Cordilleran region, occurring in the southern portion of the Coast belt, throughout the interior of British Columbia as far north as the 56th parallel of north latitude and extending to the foot-hills of the Rockies in southern Alberta. It is the most important tree in British Columbia and furnishes more lumber than any other species in the Dominion. It reaches its best development in the moist equable climate of the Coast, where it ordinarily attains a height of from 175 to 200 feet, and a diameter of from 3 to 6 feet and occasionally 250 feet in height and 10 feet in diameter, and frequently yields 50,000 to 100,000 feet board measure per acre. In the drier regions of the Interior plateau it does not grow to such large sizes nor are the stands so heavy.

The wood is light-yellow to reddish in colour, with decided annual rings of summer-wood. Its chief characteristic is its strength; it is the strongest wood for its weight in America, and, though hard enough for flooring, is not difficult to work.

It is especially valuable for all forms of heavy construction where large sizes and strength are required, but it is also suitable for light construction, and its attractive grain and hard mar-resisting surface render it a very desirable wood for interior finish.

Douglas fir reproduces readily when the seeds can reach mineral soil and light is available, and it grows very rapidly under favourable conditions.

Hemlock.—There are three species of hemlock, two of which are commercially important.

EASTERN HEMLOCK (*Tsuga canadensis*) is found in the southern parts of Ontario and Quebec and throughout the Maritime Provinces. It is frequently associated with the tolerant hardwoods. The wood is of a coarse uneven texture, easily checked and apt to warp, but its strength and cheapness have led to its use for rough construction, railway ties, boxes, and crates. It could be used for pulpwood.

WESTERN HEMLOCK (*Tsuga heterophylla*), which occurs throughout the Coast and Interior Wet belts in British Columbia, is a much superior tree. It attains a height of from 125 to 160 feet and a diameter of from 2 to 3 feet, rarely 5 feet. The wood is very light-coloured, usually a greyish-white, and the grain is straight, and, though distinct, not so prominent as in Douglas fir. It is strong and does not split readily and is suitable for all but the heaviest construction. It takes a good finish and makes a very attractive interior finish. Appreciation of its value as lumber is increasing. Over 50 per cent of the pulpwood used in British Columbia is hemlock, and it makes excellent ground-wood or sulphite pulp.

Cedar.—Two species of the genus *Thuja* occur in Canada. They are sometimes called "arbor-vitae."

WESTERN RED CEDAR (*Thuja plicata*) is found in regions of abundant precipitation in the Coast and Interior Wet Belts of British Columbia. It grows to such large sizes, frequently 150 feet high and 10 feet in diameter, that it is sometimes called the "giant cedar." It ranks second only to Douglas fir in commercial importance in British Columbia, and there is an abundant supply. The wood is light, soft, and not strong, but, owing to its resistance to decay and its

freedom from warping, shrinking, and checking, it is exceptionally durable when exposed to the weather. It is the principal wood used for roofing shingles in Canada and the United States. The colour varies from a light straw to dark reddish-brown and is very pleasing in interior wood-work. It is also used more than any other wood for telephone and telegraph poles and posts. Its lightness, durability, and straight grain make it valuable for small boats and canoes.

EASTERN CEDAR (*Thuja occidentalis*) is a much smaller tree not often over 2 feet in diameter. It grows in moist situations from eastern Manitoba to the Atlantic coast. The wood is slightly harder than that of the western red cedar, but it has the same durable qualities which make it especially valuable for shingles, poles, posts, and boat-building. The supply is becoming seriously depleted.

Balsam Fir.—This is a general common name given to all the species of *Abies*, the true firs, though the eastern species, *Abies balsamea*, is the one to which this name is usually applied.

BALSAM FIR (*Abies balsamea*) is widely distributed in the Great Plains and Eastern regions. It is usually found associated with white or red spruce. Though inferior in quality, the wood is somewhat similar to spruce; it is sawn into lumber to some extent, but its principal use is for pulpwood. It is a quick-growing tree, but its value in the forest is decreased by its susceptibility to damage by insects and fungi. It is from this tree that the Canada balsam of commerce is derived.

LOWLAND FIR (*Abies grandis*) occupies moist situations in the southern parts of the Coast and Interior Wet belts in British Columbia. Under favourable conditions it grows rapidly, and may reach a height of 125 to 175 feet and a diameter of from 3 to 4 feet. The wood is white, light and soft and makes fair lumber and good pulp.

AMABILIS FIR (*Abies amabilis*) is confined to the Coast Belt, but it extends north to Alaska. In general characteristics of growth and wood it resembles lowland fir.

ALPINE FIR (*Abies lasiocarpa*), as the name implies, grows at higher altitudes throughout British Columbia. Though a small tree, seldom over two feet in diameter, it is valuable for pulpwood.

Larch.—There are three species of larch in Canada, but one (*Larix Lyallii*) is a small alpine species.

WESTERN LARCH (*Larix occidentalis*) is confined to the southern interior portion of British Columbia in an intermediate zone between the Dry and Wet belts. It is usually found in a mixed stand with Douglas fir. It grows to a diameter of from 2 to 4 feet and a height of from 100 to 160 feet. The wood is heavy, hard, and strong, with very distinct rings of summer-wood. It is good wood for general construction or finish, and that it is not more abundant is to be regretted.

TAMARACK, or EASTERN LARCH (*Larix laricina*), is a smaller species found in poorly drained sites, usually associated with black spruce, from the foot-hills of the Rockies to the Atlantic coast and to the limit of tree growth in the north. The wood is heavy, hard, and strong, and resists decay. It is much sought after for railway ties and is also used to some extent for lumber. Where hardwood is not available, it is in demand for fuel. During the last thirty or forty years, practically all the mature tamarack has been killed by the sawfly, but many of the dead standing trees are still sound.

Yellow Cypress.—Yellow Cypress (*Chamaecyparis nootkatensis*) is a British Columbia coast species, occurring at high altitudes in the south but descending to tide-water along the northern coast. The wood is bright sulphur in colour, even in texture, and is perhaps the heaviest and hardest coniferous wood in Canada. It is practically unaffected by changes in moisture, and is valuable as a cabinet-wood and for woodwork on boats. The supply of yellow cypress is limited.

Birch.—There are seven species of birch in Canada which reach tree size, but the yellow, paper, and western species are the only ones of importance.

YELLOW BIRCH (*Betula lutea*) is the most important hardwood in the Dominion from the standpoint of lumber production. It is found in commercial quantities in the Maritime Provinces and westward to the east side of lake Superior. It also occurs along the International Boundary from Fort William to the lake of the Woods. It is the largest of the native birches, reaching a height of 75 to 100 feet and a diameter of from 2 to 4 feet. It is a shade-enduring species and is therefore classed as a tolerant hardwood. The wood is hard, strong, and even in texture, taking a fine polish, and is used extensively for flooring, cabinet-work, vehicle stock, handles, and furniture. Yellow birch also furnishes a considerable proportion of the wood used for fuel and distillation.

PAPER BIRCH (*Betula alba* var. *papyrifera*) is widely distributed, extending to the northern limit of the forests. It is a small tree, usually about 50 feet high and 8 to 10 inches in diameter. It is a short-lived tree, intolerant of shade, and reproduces prolifically on old burns. In pure stands or mixed with aspen, it forms a temporary type over large areas. The wood is inferior to yellow birch, but is valued for turnery and fuel, and there is a possibility of its being used as pulpwood.

WESTERN BIRCH (*Betula occidentalis*), which is considered by some botanists as a variety of *Betula alba*, is found in British Columbia and is very similar to the paper birch.

Maple.—Nine species of maple occur in Canada, but four are dwarf species. They are all tolerant of shade.

SUGAR MAPLE (*Acer saccharum*), also known as hard maple, has the best wood and is also valuable as the source of maple sugar and syrup. Its range coincides with that of yellow birch, with which it is usually associated, extending from the Maritime Provinces to lake Superior and from Fort William to the lake of the Woods.

Mature trees are usually from 80 to 90 feet high and 2 to 3 feet in diameter, but sometimes larger. The wood is heavy, hard, and even-grained and is used for flooring, furniture, agricultural implements, and interior woodwork. It is also one of the best woods for fuel and distillation.

RED MAPLE (*Acer rubrum*) occurs throughout the same range as sugar maple but extends slightly farther north. The wood is softer and not of such good quality as sugar maple, but is used for the same purposes.

SILVER MAPLE (*Acer saccharinum*) is more limited in its distribution, being confined to the southern portions of Ontario, Quebec, and New Brunswick. The wood of this species is also inferior to sugar maple.

BROAD-LEAVED MAPLE (*Acer macrophyllum*) occurs in moist bottomlands in the Coast Belt in British Columbia. It is not of much commercial importance but is used for ornamental planting.

MANITOBA MAPLE (*Acer Negundo*) is a native of the great Plains. It is a small tree with soft, coarse-grained wood of little value, but owing to its hardness and quick growth it is valuable for the planting of wind-breaks on the prairies.

Basswood.—Only one species (*Tilia americana*) occurs in Canada. It is found throughout the Tolerant Hardwood belt in eastern Canada and in the southern portion of Manitoba. It is ordinarily 60 to 70 feet in height and 2 to 3 feet in diameter, with a long straight trunk. The wood is one of the most valuable in the Dominion. It is white, odorless, and tasteless and, though soft and light, is tough and strong. It is especially desirable for slack cooperage and boxes for food products, but it is also used for a great variety of purposes, such as furniture, vehicle bodies, interior finish, and veneer.

Elm.—There are three species of elm native to Canada.

WHITE ELM (*Ulmus americana*) has a wider distribution than any other tolerant hardwood, extending from Saskatchewan to the Maritime Provinces. It attains considerable size, 50 to 125 feet in height and 2 to 7 feet in diameter. The wood is strong and tough, but not easily worked. It is used for cooperage, veneer, vehicle stock and implements.

ROCK ELM (*Ulmus racemosa*) is found chiefly in southern Ontario. The wood is similar to white elm, but is even tougher and stronger.

RED ELM (*Ulmus fulva*) occurs in the southern portions of Ontario and Quebec. The wood is much inferior to other elms and is not extensively used.

Poplar.—Of the seven indigenous species of poplar only three are of commercial importance.

ASPEN (*Populus tremuloides*), though the most widely distributed species in Canada, is as yet used only to a limited extent in the forest industries. The wood is light, soft, and tough, and, though sawn into lumber in some districts where other woods are scarce, it is difficult to season and is very perishable. In the Prairie Provinces it is a valuable fuel wood. It is often preferred to other woods for excelsior, cooperage, and matches. There is the greatest opportunity for its utilization on a large scale in the manufacture of paper. It is a hardy, quick-growing, but short-lived tree, and is seldom sound after it reaches 8 to 10 inches in diameter. It reproduces prolifically both by coppice and seed, and quickly becomes established on burned-over lands. If conifers are present, however, its tenure of the soil is only temporary.

BALSAM POPLAR (*Populus balsamifera*) has as wide a range as aspen, but is confined to rich moist sites such as the banks of rivers and bottomlands. It grows to larger sizes than aspen and the wood is similar.

BLACK COTTONWOOD (*Populus trichocarpa*) is confined to the Pacific coast where it grows on moist alluvial soils along the valley bottoms. It is a large tree, 3 to 4 feet in diameter and 80 to 125 feet high, and the wood is light, soft, straight-grained, strong, tough, and odorless. It is used chiefly for veneer and boxes for food products, but could be used for pulp.

Ash.—There are five kinds of ash in Canada, chiefly confined to eastern Canada, though green ash is native to Manitoba and Saskatchewan.

WHITE ASH (*Fraxinus americana*), the most important species, occurs in the southern portions of Ontario, Quebec and the Maritime Provinces. It is usually 50 to 60 feet in height and 2 to 3 feet in diameter with a tall straight trunk. The wood is hard, tough, and elastic, and is used for vehicles, cars, agricultural implements, tool-handles, skis, and to some extent for interior woodwork.

Beech.—Beech (*Fagus grandifolia*) is a prominent species in the Tolerant Hardwood belt. It attains a diameter of from 2 to 3 feet and a height of 70 to 80 feet. The wood is hard and strong, but difficult to season and work. It is used for flooring, furniture, vehicle stock, coop-
erage, handles, wood distillation, and fuel.

Oak.—There are 12 species of oak in Canada, most of them confined to the Southern Hard-
wood belt, but one species (*Quercus Garryana*) occurs in British Columbia. White oak (*Quercus
alba*) is the most valuable, but the supply is very limited. The wood is hard and strong and has
a beautiful grain when sawn radially, which makes it especially valuable for interior finish,
cabinet-work, and furniture.

RED OAK (*Quercus rubra*) is more widely distributed, and, though the wood is not so strong
nor so attractive as white oak, it is used for the same purposes.

5—Ownership of Forests

In Canada the general policy of both the federal Government and the provincial Govern-
ments has been to dispose of the timber by means of licenses to cut, rather than to sell timber-
land outright. Under this system the State retains the ownership of the land and control of the
cutting operations. Revenue is derived in the form of stumpage bonuses (either in lump sums
or in payments made as the timber is cut), annual ground rent, and royalty dues collected as
and when the wood is removed. Both ground rent and royalty dues may be adjusted at the
discretion of the governments so that the public may share in any increase in stumpage values,
or, as has happened, reductions may be made in the rates if conditions demand them.

The Maritime Provinces did not adopt this policy to the same extent as did the rest of Canada.
In Prince Edward Island all the forest land has been alienated and is in small holdings, chiefly
farmers' woodlots. In Nova Scotia 76 per cent of the forest land is privately owned; nearly
half of this is in holdings exceeding 1,000 acres. In New Brunswick nearly 50 per cent has been
sold, and 20 per cent is in holdings exceeding 1,000 acres. The percentage of privately owned
forest land in the other provinces is as follows:—Quebec, 7 per cent; Ontario, 3.3 per cent;
Manitoba, 11.3 per cent; Saskatchewan, 10.4 per cent; Alberta, 15.7 per cent, and British
Columbia, 13 per cent.

In Canada, as a whole, only 9.6 per cent of the forest land has been permanently alienated;
on 13.2 per cent cutting rights are held under lease or license, and 77.2 per cent is not alienated
in any form. Only 6.6 per cent has been permanently dedicated to forest production. This
includes the (federal) National Forests, and provincial forest reserves and parks in which
utilization is permitted. There are licensed berths within these reserved areas. About 92.7
per cent of the state-owned forest land has not yet been withdrawn from sale or settlement
and definitely set aside for forestry purposes.

Naturally the more heavily timbered and accessible tracts have been alienated, so that on
the basis of total timber content, it is estimated that about 10 per cent of the forest resources
of the Dominion is in private ownership, 40 per cent under license or lease, and 50 per cent still
unalienated.

TABLE II—FOREST AREA BY OWNERSHIP

Type of forest	Forests owned by the State				Forests owned by corporate bodies and private individuals	Total
	Dedicated to timber production	Under lease or license	Unalienated	Total state		
	(1) Square miles	(2) Square miles	(3) Square miles	(4) Square miles	(5) Square miles	(6) Square miles
Accessible—						
Merchantable.....	23,000	100,000	161,234	261,234	50,000	311,234
Young Growth.....	43,500	35,000	469,646	504,646	50,000	554,646
Inaccessible and unprofitable.....	9,545	17,341	258,168	275,509	10,065	285,574
Total.....	76,045	152,341	889,048	1,041,389	110,065	1,151,454
Percentage of total forest area.....	6.6	13.2	77.2	90.4	9.6	

NOTE.—State forest land not definitely dedicated to timber production may be calculated by subtracting 1 from 4.

TABLE IIa—AREAS OF FOREST RESERVES AND PARKS

DOMINION NATIONAL FORESTS

	Area Sq. miles	Total Square miles
<i>In British Columbia—</i>		
Yoho.....	127.35	3,024.45
Glacier.....	106.00	
Larch Hills.....	43.12	
Mount Ida.....	43.50	
Fly Hill.....	219.50	
Martin Mountain.....	33.75	
Monte Hills.....	182.25	
Niskonlith.....	311.68	
Long Lake.....	262.34	
Tranquille.....	277.83	
Nicola.....	502.00	
Arrowstone.....	251.75	
Hat Creek.....	337.50	
Shuswap.....	326.00	
<i>In Alberta—</i>		
Cypress Hills No. 1.....	80.69	18,950.23
Cooking Lake.....	60.50	
Rocky Mountains.....	13,786.04	
Lesser Slave.....	5.023.00	
NOTE.—The Rocky Mountains Forest Reserve is divided for administrative purposes into five “forests” as follows:—Crowsnest 1,303.90 sq. miles; Bow River, 2,135.14 sq. miles; Clearwater, 4,511.00 sq. miles; Brazeau, 2,244.00 sq. miles; Athabaska, 3,592.00 sq. miles.		
<i>In Saskatchewan—</i>		
Moose Mountain.....	154.00	8,324.98
Beaver Hills.....	68.00	
Porcupine No. 2.....	2,790.50	
Pasquia.....	2,535.25	
Fort à la Corne.....	504.10	
Pines.....	160.68	
Nisbet.....	154.65	
Big River.....	1,321.00	
Seward.....	30.75	
Elbow.....	119.00	
Dundurn.....	62.75	
Keppel.....	64.25	
Manito.....	180.95	
Duck Mountain No. 2.....	81.00	
Cypress Hills No. 2.....	98.10	
<i>In Manitoba—</i>		
Sandilands.....	189.30	3,871.13
Turtle Mountain.....	109.25	
Spruce Woods.....	223.50	
Riding Mountain.....	1,148.04	
Duck Mountain No. 1.....	1,426.29	
Porcupine No. 1.....	774.75	
Total Dominion National Forests.....		34,170.79

CANADIAN NATIONAL PARKS

	Area Sq. miles	Total Sq. miles
<i>In Alberta—</i>		
Buffalo.....	197.05	8,662.00
Elk Island.....	51.00	
Jasper.....	5,380.00	
Nemiskam.....	8.05	
Rocky Mountains.....	2,751.00	
Wawaskesy.....	54.00	
Waterton.....	220.00	
<i>In British Columbia—</i>		
Glacier.....	468.00	1,631.00
Kootenay.....	587.00	
Mount Revelstoke.....	100.00	
Yoho.....	476.00	
<i>In Saskatchewan—</i>		
Prince Albert.....	1,377.00	1,377.03
Vidal Point (17.2 acres).....	0.03	
<i>In Ontario—</i>		
St. Lawrence Islands (175 acres).....	0.28	4.28
Point Pelee.....	4.00	
<i>In New Brunswick—</i>		
Fort Howe..... (19 acres).....	0.03	0.12
Fort Beausejour..... (59 acres).....	0.09	
<i>In Nova Scotia—</i>		
Fort Anne (31 acres).....	0.05	0.05
Total of Canadian National Parks Areas.....		11,674.48

PROVINCIAL FOREST RESERVES AND PARKS

<i>British Columbia Forest Reserves</i>	Sq. miles	Total Square miles	
Elk River.....	100		
Okanagan.....	805		
Little White Mountain.....	291		
Grizzly Mills.....	593		
Aberdeen Mountain.....	118		
Inkaneep.....	391		
Kettle River.....	2,426		
Yahk.....	788		
Aleza Lake.....	10		
Nehalliston.....	907		
Hardwicke Island.....	26		
West Thurlow Island.....	30		
Sonora Island.....	57		
Babine.....	2,000		
Shuswap.....	650		
East Thurlow Island.....	34		
Morice.....	925		
Redonda.....	65		
Total of British Columbia Forest Reserves.....		10,146	
<i>British Columbia Park</i>			
Strathcona Park.....	828		
Mount Assiniboine.....	20		
Mount Robson.....	760		
Kokanee Glacier Park.....	100		
Total of British Columbia Provincial Parks.....		1,708	
Total of British Columbia Reserves and Parks.....			11,854
<i>Ontario Forest Reserves</i>			
Nipigon.....	7,300		
Timagami.....	6,000		
Mississauga.....	4,896		
Eastern.....	100		
Sibley.....	70		
Total of Ontario Forest Reserves.....		18,366	
<i>Ontario Parks</i>			
Algonquin.....	2,741		
Quetico.....	1,700		
Rondeau.....	8		
Total of Ontario Provincial Parks.....		4,449	
Total of Ontario Forest Reserves and Parks.....			22,815
<i>Quebec Forest Reserves</i>			
St. Maurice Reserve.....	2,500		
45 Township Reserves.....	643		
Total Quebec Forest Reserves.....		3,143	
<i>Quebec Parks</i>			
Gaspé Park.....	2,500		
Laurentide National Park.....	3,271		
Total of Quebec Provincial Parks.....		5,771	
Total of Quebec Forest Reserves and Parks.....			8,914

6—Relationship of the State to the Forest

A—SUMMARY OF EXISTING LEGISLATION

DOMINION

The Dominion Government administers the forests in the provinces of Manitoba, Saskatchewan, and Alberta, in the Railway Belt and Peace River Block of British Columbia, and in the Yukon and Northwest Territories. Dominion Lands are under various branches of the Department of the Interior as described in Section 7.

Dominion Lands Act

The Dominion Lands Act provides for the disposal of timber on Dominion Lands through the system of granting permits and licenses to cut timber, the Crown retaining title to the land. Authority is granted to the Governor in Council by this Act to make regulations governing these permits and licenses which are under the control of the Timber and Grazing Lands Branch of the Department of the Interior. Permits of different kinds are granted without public competition to settlers, portable-sawmill owners, mine operators, etc., and are limited to a specified area and a stated quantity of wood required for immediate use. Dues varying with the class of material cut are collected as and when the timber is removed. An annual ground rent of \$25 per 160 acres is charged.

Licenses are disposed of by public auction to the one offering the largest cash bonus in excess of an upset price fixed by the Department. The license is granted for a definite surveyed area known as a "berth," and is issued annually with the privilege of renewal from year to year while there is on the berth timber of the kind and dimensions described in the license in sufficient

quantity to be commercially valuable, provided the regulations have been followed and the land is not required for other purposes. Licenses cannot be assigned or transferred without the consent of the Minister. In addition to the cash bonus, the licensee pays a fee of \$2, an annual rental of 10 cents per acre in the Coast District of the Railway Belt and \$10 per square mile elsewhere, and royalty dues on the timber cut. A fire-protection tax amounting to one-half the cost incurred by the Crown in protecting the timber from fire is collected annually. The rental and royalty may be increased or decreased at any renewal. The regulations provide for a minimum-diameter limit, removal of all merchantable timber, disposal of debris, protection from fire, and the protection of the young growth. Timber cut from Crown lands must be manufactured in Canada.

Dominion Forest Reserves and Parks Act

The Dominion Forest Reserves and Parks Act permanently dedicates certain defined areas, designated as Dominion Forest Reserves, for "the maintenance, protection and reproduction of timber" and other areas as Dominion Parks to be maintained and made use of as "public parks and pleasure grounds for the benefit, advantage and enjoyment of the people of Canada."

The Forest Reserves, or National Forests as they are now called, are under the control and management of the Director of Forestry. Having been created for the production of timber and for the purposes of watershed protection, the fullest possible use is made of the timber and grazing resources consistent with the maintenance of sustained or augmented production of wood, forage, and other products.

The National Parks are under the control and management of the Commissioner of Canadian National Parks. The underlying principle in the establishment of national parks being that the lands embraced should be maintained in a natural state, commercial exploitation is not permitted within the National Parks.

The timber in the National Forests is disposed of by permits and sales without competition for small amounts and by timber sales by tender for larger amounts. The timber is sold only for immediate operation, and must be cut under stipulated conditions embodied in the agreement of sale. These include the complete utilization, the disposal of slash, the protection of growing stock, and the leaving of seed-trees as the local conditions demand. Close supervision is maintained, and failure to comply with the conditions of the sale results in the cancellation of the sale and the forfeiture of a substantial deposit. The grazing of live stock is permitted under regulations which ensure both the protection of the forest and the forage and an equitable distribution of these privileges. Permits to cut hay are also granted.

Fire Protection in National Forests.—Strict regulations for the protection of the National Forests from fire are provided for in this Act. During a closed season from April 15 to November 15 permits are required for the setting out of fire in the open, except for cooking or camping purposes, and this season may be extended by the Director of Forestry during periods of special danger.

Fire Protection outside National Forests.—The Forest Service provides fire protection throughout the Dominion Lands, except on the National Parks, and in the Territories, where separate organizations are maintained. Outside of the Forest Reserves and Parks the Forest Service has recourse to provincial legislation regarding fire. All of the western provinces have established closed fire seasons by law and require permits for setting fire during the months of danger. They also provide against the usual hazards and prescribe penalties for incendiarism or carelessness.

Railway Act

The Railway Act gives very wide powers to the Board of Railway Commissioners in regard to fire protection along the railways under its jurisdiction, which now includes practically all of the 41,000 miles of railway in the Dominion. The provisions of the Act fall under six classes, namely,

1. The use of fire-protective appliances on locomotives,
2. The establishment and maintenance of a properly equipped patrol staff by the railways,
3. The regulation of locomotive fuel,
4. The clearing of rights of way,
5. The financial responsibilities of railway companies for fire loss due to railway locomotives,
6. The construction and maintenance of fireguards along railway lines.

Through the orders issued by the Board under this Act and the co-operation of the companies secured thereby, the fire loss due to railways has been very greatly reduced.

BRITISH COLUMBIA

Land Act, 1884

This Act and amendments provided for the sale of land and the disposal of timber under leases and licenses to cut. Though it originally stated that "no land chiefly available for timber shall be disposed of by public or private sale", it was not until 1896, when timberland was specifically defined as land carrying 8,000 feet board measure per acre when situated on the Coast and 5,000 feet board measure in the Interior, that this policy was enforced.

Forest Act, 1912

The Forest Act established the Forest Branch in the Department of Lands and placed under its jurisdiction the entire administration of the forests, including the disposal of timber, collection of revenue, regulations of cutting, forest protection, reforestation, and market extension.

Taxation Act

This Act imposes a tax of two per cent on the assessed valuation of privately owned timberland.

Summary of Present Conditions of Tenure—

Crown Grants.—Timber cut from land granted prior to April 7, 1887, is free of royalty, but is subject to a manufacturing tax which is rebated if the timber is manufactured within the province.

Timberlands purchased subsequent to that date and prior to March 12, 1906, are subject to a royalty of 50 cents per thousand feet board measure, and the logs are exported without charge.

Lands granted after March 12, 1906, till March 1, 1914, are subject to a royalty of 50 cents per thousand feet board measure, and the logs are not exportable.

Timber cut from lands granted since March 1, 1914, is subject to the same royalty as special licences and must be manufactured in the province.

Timber Leases.—The leasing system goes back as far as 1870. The leases were originally issued for a term of 21 years, renewable under conditions to be determined by the Government. They are now all on the same terms as special licenses.

Pulp Leases.—In 1901, provision was made for granting leases to pulp and paper companies, which were renewable for consecutive periods of 21 years. The annual rental is one-half the rental on special licenses and the royalty 25 cents per cord (700 feet board measure, or 100 cubic feet).

Special Licences.—Most of the alienated timber is held under special licenses, which are limited to 640 acres each. They are renewable annually in perpetuity, subject to cutting regulations in force from year to year. After cutting, the licence lapses, or renewal may be refused if the land is required for agriculture. An annual ground-rent of \$140 per square mile is charged west of the Coast-Cascade mountains and \$100 per square mile east of that range. The scale of royalty is adjusted at intervals of five years, and, in the case of logs, it varies as to whether on the Coast or in the Interior and as to the species and quality. Other products, such as ties, poles, pulpwood, etc., carry individual rates.

Timber Sales.—Since 1908, Crown timber has been disposed of only by timber sales, which are awarded after public competition to the one bidding the highest stumpage price. Each sale contract specifies the period within which operations are required to be completed. The ground-rent is the same as on special licenses.

Manufacturers of Crown Timber.—In order to encourage home manufacture, the exportation of raw material, logs, bolts, poles, piling, etc., cut from private lands granted subsequent to March 12, 1906, and from all Crown lands (leases, licenses, and timber sales) is prohibited, except under special permit and the payment of an export tax. To assist the government in regulating export, an Advisory Committee representing equally the logging industry, the lumber manufacturers, and the Forest Service meets each month to review the situation and pass on the applications for export permits.

Forest Protection Fund.—All alienated Crown Lands and privately owned lands classified and taxed as timberlands under the Taxation Act are required to contribute towards the Forest Protection Fund. The present tax is $2\frac{1}{2}$ cents per acre per annum. The Government contributes an additional \$300,000 annually. The fund is administered by the Forest Branch exclusively for forest fire protection.

Timber Measurement.—All timber for which a royalty is payable is scaled and graded by government scalers. A small fee which pays for this service is charged.

ONTARIO

Crown Timber Act

The power of the Minister of Lands and Forests to dispose of timber on public lands is derived from The Crown Timber Act. This Act, with the Regulations made thereunder, is concerned with such matters as conditions governing disposal, cutting, scaling, collection, trespass, distress proceedings, manufacture, etc.

The sale of saw-timber is by tender after examination and public advertisement for 60 to 90 days of the terms and conditions applying to the particular sale. These contain, besides subjection to the usual regulations, clauses stating a definite removal period, stipulating the disposal of all slash about camps and dumps, along "tote" roads and railways, and such other points as the Department may require, and requiring a cash deposit until cutting is completed to ensure fulfilment of contract.

The successful tenderer is the person who offers to pay the highest bonus per product unit in excess of the set rates of Crown dues. There is also a ground-rental charge of \$5 and a fire-

tax charge of \$6.40 annually per square mile. These rates and charges are subject to change by Order in Council, but are always fixed for a definite period—10 or, lately, 5 years—in order to give stability to the lumber business.

The license to cut is granted for one year only, with the right of renewal if the observance of the regulations is satisfactory.

The sale of pulpwood areas is by individual agreements, good for 21 years. These agreements stipulate a minimum mill capacity, cost, and number of persons employed, and miscellaneous conditions according to the area concerned.

The payment of Crown dues is based on measurement in the woods by government scalers, half of whose wages is collected from the licensee.

Since 1897, all softwood timber cut from Crown lands has had to be manufactured in Canada, all pulpwood since 1900, and all hardwood since 1926.

The Forestry Act

Provides power to acquire lands for forestry purposes, and for the administration and management of such lands, gives power to enter into agreements for the purposes of reforestation and managing lands held by persons, corporations, or municipalities, gives power to remove settlers from unsuitable areas, and to place them on lands suitable for agriculture.

This Act also provides for the establishment of a Forestry Board to consist of five members for the purpose of carrying on research work in connection with the forestry lands of the province.

Forest Fires Prevention Act

All the province except the southerly agricultural portion comes under the provisions of this Act, for the purposes of forest protection. The Act establishes a close season throughout the province from April 15 to September 30, during which fires may be set out for clearing land, disposal of debris, or for any industrial purpose, only under circumstances and subject to conditions prescribed by the regulations. The Act provides for the extension of the close season, use of permit system, regulation of engines and burners, prevention of the creation of fire hazards, etc. There is provision for the compulsory clearing up of any conditions, including slash from ordinary logging operations, which may be a fire menace. This applies also to private lands. If the clearing is not done by the owner, it may be carried out independently and the cost collected. There is the customary provision for the organization of personnel, purchase of equipment, and carrying on of improvement work, so as to carry out the intent of the Act.

Fires Extinguishment Act

This is a little-known Act meant mainly for application outside the provincial fire district. It provides that township and county councils may, by by-law, empower certain of their officials to compel the local people to fight woods fires.

Fire Guardians Act

This Act provides for municipalities outside the fire districts (Forest Fires Prevention Act) appointing fire guardians to have control of the setting out of fire.

Forest Reserves Act

This Act permits establishment of a forest reserve through proclamation by Order in Council. Its essential features are that settlement is prohibited, that no timber may be sold except fire-damaged or mature stands, and that surrender may be made to the Crown by the limit-holder of cut-over portions, subject to ratification by the Legislature.

Provincial Parks Act

This Act is similar to the foregoing Act, except that cutting rights may be granted by Order in Council.

Counties Reforestation Act

This Act enables municipalities, by by-law, to acquire land for reforestation purposes, manage and develop plantations, and enter into agreements for their development. A limit of \$25,000 debenture issue for land is fixed.

The Mills Licensing Act

This Act provides for the requirement of securing a license to operate sawmills or pulp and paper mills, and provides also for the control of locating mills and prescribing the returns to be made as to sources of supply of raw material and quantities used therein.

The Timber Cutting Regulation Act

This Act provides power for the Minister of Lands and Forests to fix the size and kind of trees and timber which may be cut from Crown Lands and on patented lands where the timber thereon remains the property of the Crown.

QUEBEC

Lands and Forests Act

The laws respecting lands and forests and the timber regulations in the Revised Statutes of Quebec, 1925, place the administration of the forests under the Forest Service of the Department of Lands and Forests. This includes the classification of the land, disposal of timber, regulation of cutting operations, measurement of timber cut, collection of revenue, reforestation, and all other matters pertaining to the forests.

Licenses to cut timber are disposed of by public competition to the bidder of the highest stumpage bonus in excess of a fixed bonus per square mile, and the regular royalty on timber cut. An annual ground-rental is also charged. Licences are renewable from year to year, but the rate of royalty and of ground-rent may be changed by the Government at any time. The export of unmanufactured wood from Crown lands is prohibited. The timber cut is measured by licensed scalers, and operators by whom they are employed are required to make returns of the amounts. Minimum-diameter limits to which the timber may be cut are fixed, but modifications are allowed when working plans acceptable to the Forest Service show that such are necessary for the best silvicultural practice. Logging operations are inspected by the forest engineers of the Service, and when deemed advisable the amount to be cut is prescribed. It is the aim of the Department to limit the cut to forty per cent of the increment.

Special efforts have been made toward ensuring a more conservative utilization of the exploited timber and reducing waste in the course of lumber operations. Regulations call for detailed inventories being made by the limit-holders. Since 1922, forest surveys have been completed on 20,000 square miles. In 1924, fire protection was placed under a special Forest Protective Service.

Land may be reserved for forestry by order of the Lieutenant Governor in Council in the form of Forest Reserves, Crown Forests, or Township Forest Reserves. Parks are established under special legislation.

The Forest Research Promotion Act

The Forest Research Promotion Act provides for maintenance of the School of Forestry, the School of Forest Rangers, and the School of Papermaking, and the establishment of forest-research stations and laboratories.

The Quebec Cullers Act provides for the examination and licensing of cullers or scalers of timber cut on Crown lands.

The Water Course Act and Timber Driving Company Act govern the driving of logs on streams and rivers.

NEW BRUNSWICK

The administration of land and timber was originally provided for by the Crown Lands Act. Subsequently the Forest Act 1918, The Scalers Act, The Forest Service Act, and the Forest Fires Act were passed and are embodied in the Revised Statutes of New Brunswick, 1927.

The following are the main features of this legislation as at present in force:—

The Forest Service under the Minister of Lands and Mines was created in 1918, "to administer all the statutes, rules, and regulations respecting forestry, hunting and fishing, forest and game protections." A Forestry Advisory Commission, consisting of the Minister of Lands and Mines, the Deputy Minister, the Chief Forester, a lumberman representing the licensees of Crown Lands, and one representing the private timberland owners is appointed to advise on matters of policy.

Private Lands.—All private forest land in tracts of 500 acres or more in area is subject to a wild land tax of two cents per acre. In Westmoreland County all private timberland of 50 acres or more is taxed for fire protection, the rate being based on the cost of the service. In other counties, the owners are required to extinguish fires on their own land, and if they fail to do so, the municipality is required to do so, and the owner of the land has to pay all the costs.

Leases.—Cutting rights are granted under leases disposed of by public auction. They are subject to a bonus varying from \$20 to \$100 per square mile for sawmill licensees and up to \$130 per square mile for pulpwood licensees. An annual rental of \$8 per square mile is charged, and a royalty is payable as the timber is cut. Regulations regarding the stumpage rates, methods of cutting, and measurement of timber may be revised, from time to time, by the Lieutenant-Governor-in-Council.

The Minister may require the holder of any license to furnish maps and estimates of the timber for his license.

The timber cut from Crown lands must be measured by licensed scalers, and sworn returns made to the government.

The Act stipulates that all logs, timber or wood, except poplar, cut from Crown lands must be manufactured within Canada into merchantable pulp or paper or into sawn lumber, woodenware utensils, or other articles of commerce or merchandise, but an amendment provides that the licensees may be granted the privilege of exporting raw material when it is shown to be in the public interest, after full inquiry into all the circumstances of each case, under such conditions and stipulations as the Lieutenant Governor in Council may deem just and equitable.

Forest Protection.—A fire-protection fund is established towards which the licensees contribute one-half cent per acre per annum and the government the balance. Fire protection on Crown lands is administered by the Provincial Forest Service.

A close season from April 15 to October 15 is established, during which no fire may be set for land clearing within one-half mile of forest land except under permit. These permits may be cancelled when weather conditions are hazardous. During dry weather permits are required by persons entering the forest. Fire-protective appliances are required on locomotives and stationary steam engines operating on or through forest land.

Fire fighting is compulsory. The men are paid when fighting fires on Crown lands, but on private lands the municipalities may call upon men to fight fire without pay.

NOVA SCOTIA

Lands and Forests Act

All provincial legislation regarding the forest and game is governed by this Act passed in 1926. It is divided into three parts, namely, Crown Lands, Forests, and Game.

Cutting Licences.—The Minister of Lands and Forests may grant licences to cut timber on the ungranted land of the Crown, on payment of such dues as may be in his discretion. The cutting licences are subject to regulations and restrictions prescribed by the Governor in Council.

Fire Protection.—Any person is liable to a penalty of not less than \$20 nor more than \$400 for each offence, if he starts a fire near the forest or for the purpose of clearing land, without exercising every reasonable care and precaution; or if such a person, between the fifteenth day of April and the first day of December, starts a fire in or near the woods for cooking purposes or any other purposes without observing certain prescribed precautions, or starts a fire for the purpose of clearing land or other like purpose without first having obtained a permit in writing from a duly appointed Forest Ranger, or operates a steam engine within sixty rods of any forest without first having obtained a permit from a duly appointed Forest Ranger.

B—SUMMARY OF ADMINISTRATIVE METHODS

The Dominion Government administers the forests on Crown land in Manitoba, Saskatchewan, and Alberta, in the Railway Belt and Peace River Block in British Columbia, and in the Yukon and Northwest Territories. In the rest of the Dominion the forests are under the control of the Provincial Governments. When Dominion lands pass to private ownership they come under provincial control for taxation and other purposes.

In general, the system of granting cutting licenses rather than selling the timberland outright has been followed by all the forest authorities; only in the Maritime Provinces has any large proportion of the forest land been permanently alienated. By the license system, the Crown retains the ownership of the land and control of the cutting operations and derives revenue in the form of ground-rent, stumpage bonuses, and royalty on the timber cut. Most of the licenses are renewable annually at the discretion of the Government and on such terms as may be fixed from time to time, though some are fixed for a definite period. In practice, however, the regulations are changed infrequently and only when justified by the conditions of the timber-using industries.

Forest services are maintained by the Dominion Government and by the provinces of British Columbia, Ontario, Quebec, New Brunswick, and Nova Scotia. These services all have charge of protection from fire, reforestation, research, and investigation. The Dominion Forest Service (Department of the Interior) administers the National Forests, but the Timber and Grazing Lands Branch of the same department disposes of the timber on Dominion forest lands outside of these forests. Except in Ontario, where the sale of timber is under a separate branch of the Department of Lands and Forests, the Provincial Forest Services have complete control of the Crown forests in the respective provinces.

The administrative methods of each are more fully described under the headings of Legislation, Assistance to Forestry, and Forest Authorities.

C.—SUMMARY OF ASSISTANCE GIVEN FORESTRY

DOMINION

The Dominion government provides free nursery stock to farmers and ranchers in the Prairie Provinces. Between 6,000,000 and 7,000,000 trees are distributed annually. Tree-planting promoters personally visit the planters of these trees and advise as to the location of the plantation, preparation of the soil, selection and arrangement of the species of trees, and the subsequent cultivation and care. Lectures on tree planting and horticulture are given. Advice is given also from the Head Office in Ottawa to owners of woodlots and shade trees, and the Research Division co-operates with the provincial governments and timber owners in silvicultural experiments and research. The Forest Products Laboratories, in addition to the fundamental research carried on, investigate special problems at the request of the wood-using industries.

A substantial grant is given annually to the Canadian Forestry Association and over \$35,000 is spent annually in publicity for forest conservation generally throughout Canada.

When Dominion lands are alienated they become subject to provincial taxation, and the Dominion government does not impose any taxation on land.

BRITISH COLUMBIA

No provision is made for direct assistance in forestry to private owners of timberland, but advice is given where requested.

The "Forest Act", Section 21A, provides for operating pulp units on a sustained-yield basis, and the reservation of Crown timber for use of operators of pulp units who agree to manage their units on working-plan regulations approved by the Minister of Lands.

General provisions of the "Taxation Act" give timberland a preferred rate over wild land.

A grant of \$5,000 is made to the Canadian Forestry Association for publicity purposes.

ONTARIO

The Department of Lands and Forests provides assistance, which in the past has been from educational motives, by providing free nursery stock to individuals, planting up municipally owned demonstration forests, co-operating in definite reforestation projects, examination of private woodlots, giving expert advice, inspection of plantations, and by grants to societies.

Provision of Nursery Stock.—Trees are distributed to private landowners for planting projects. The applicant may receive 3,500 trees free by paying the carrying charges to his nearest railway station. Quantities beyond this are charged for at the nominal price of \$4 per 1,000. About 5,000,000 trees are sent out annually in connection with this project.

County Reforestation Projects.—The older-settled part of Ontario has relatively large areas of waste sandy soil located through the strictly farming section. These have been alienated from the Crown in early days and comprise at least 200,000 acres. The Counties Reforestation Act provides machinery by which such areas may be purchased locally and utilized definitely for growing timber supplies. The county purchases at least 1,000 acres in one block and enters into agreement with the Department for its development. The Department undertakes to reforest the property, look after its further management, and to turn it over to the county at any time on payment of the expenditure incurred. Up to the present eight counties have availed themselves of this arrangement. Last season these projects used 1,054,000 trees.

Municipal Demonstration Forests.—These are projects undertaken by the smaller municipalities, such as townships, towns, or villages. The municipality purchases the land, usually from 5 acres up to a few hundred acres in extent, and the Department plants the area free of charge, while the care and maintenance devolves upon the local authorities. Sixty-five municipalities have undertaken these projects and last season this work required over 800,000 trees.

Taxation.—The Municipal Act requires the exemption of woodlands from taxation up to 10 per cent of the owners' holdings and not exceeding 20 acres of any single owner. This requires the owner to make application for such exemption.

Expert Advice.—Private woodlands and plantations are examined on application, and silvicultural treatment outlined, including pathological conditions.

Grants to Societies.—An annual grant is made to the Canadian Forestry Association.

QUEBEC

A Forest Nursery, established at Berthierville in 1908, serves as a demonstration station for the School of Surveying and Forestry and also for the Forest Ranger School. It provides planting material for distribution and sale to private owners of forest land, to educational bodies, towns, etc. It also enables the Government to make some objective plantations, such as the reclamation of shifting sands. Tree seed is collected throughout the Province, and an extraction plant is located at the nursery. The capacity of the nursery has been raised to ten million trees, as the demand for both ornamental and forest trees is developing rapidly. The danger of forest fires in the past has been such that it has been found more reasonable to protect the natural reproduction than to risk plantations in exposed places, but, with the reduction of the fire hazard, planting is now being conducted at the rate of 3,000,000 trees per annum.

Expert advice is given by members of the staff on forestry problems that are submitted to the Department, and an annual grant is made to the Canadian Forestry Association.

The School of Forestry and Surveying at Laval University in the City of Quebec was established and is supported by the provincial Government.

Provision is made by legislation for the creation of township communal forests, and settlers and others are encouraged and assisted to devote a part of their holdings to timber production. For each acre of land planted with forest trees the owner is entitled to a bounty of \$10 after five years.

NEW BRUNSWICK

A seed-extraction plant and a nursery with an annual output of 2,500,000 seedlings were established at Fredericton in 1923. Seed and planting stock are sold practically at cost. Technical advice is given to timberland owners or licensees. The province makes an annual grant to the Canadian Forestry Association. Active co-operation is maintained with the Dominion Forest Service, and the Entomological and the Plant Pathology Branches of the federal Department of Agriculture.

NOVA SCOTIA

Nursery stock is provided free of cost to any citizen of the province upon application, from the provincial forest nursery. The Chief Forester is available to any citizen of the province who may require his services for expert advice. The provincial Government is assisting the Canadian Forestry Association with an annual grant.

7—Forest Authorities

DOMINION

The Dominion Government administers the Crown lands in the provinces of Manitoba, Saskatchewan, and Alberta, in the Yukon and Northwest Territories, and in three areas in British Columbia. As an outcome of the terms of the union in 1871, the province of British Columbia, in 1883, ceded to the Dominion Government, in consideration of the construction of the Canadian Pacific railway, a strip of territory known as the "Railway Belt," extending 20 miles on each side of the railway from the Alberta boundary to the head of Burrard Inlet on the Pacific coast, comprising approximately 17,150 square miles. To compensate for the lands in the Railway Belt which had already been disposed of (some 461 square miles), the Dominion Government was allowed to select a further 3,500,000 acres from Provincial lands, and 5,419 square miles were in 1907 selected in the Peace River district. This tract is known as the Peace River Block. Some 2,264 square miles of coal-bearing lands in the Crowsnest pass in the south-eastern part of British Columbia are also under federal administration.

The forests on Dominion lands are administered by four branches of the Department of the Interior, namely, the Forest Service, the Timber and Grazing Lands Branch, the Canadian National Parks Branch, and the Northwest Territories Branch.

Indian reserves, which are distributed throughout the Dominion and comprise 7,694 square miles, of which 4,037 square miles are wooded, are administered in trust for the Indians by the Department of Indian Affairs.

The Board of Railway Commissioners for Canada has charge of the fire protection along the railway lines subject to its jurisdiction. These various authorities will be described separately.

Forest Service

The Forest Service administers the National Forests, provides the fire protection on Dominion Lands in the four western provinces (except in the National Parks), assists tree planting on the prairie farms, conducts forest-resources and industrial investigations and silvicultural and forest-products research throughout the Dominion.

The Head Office is in Ottawa, and district headquarters are located at Winnipeg, Manitoba; Prince Albert, Saskatchewan; Calgary, Alberta; and Kamloops, British Columbia. The headquarters of the Tree-planting Division are at Indian Head, Saskatchewan, with a branch nursery at Sutherland, Saskatchewan. The main Forest Products Laboratory is in Ottawa with branch laboratories at Montreal, Quebec, and Vancouver, British Columbia.

The head-office staff consists of the Director of Forestry, Associate Director, 15 technically trained foresters and engineers and a clerical staff of 45. The Head Office comprises five Divisions, namely, Administration, Protection, Resources, Management, and Silvicultural Research.

Each of the four districts is under a District Forest Inspector, who has charge of the National Forests and the fire protection in the district. (The Districts follow closely the provincial boundaries.) In each district office there are division chiefs in charge of fire protection and forest management. Alberta has also a district chief of grazing.

The National Forests staff consists of 14 supervisors, 30 foresters, 2 engineers, 100 permanent rangers, 65 seasonal rangers, and 28 clerical employees. The fire-ranging staff outside of the National Forests includes 7 permanent rangers, 4 office employees, and 164 seasonal rangers.

The Tree-planting Division, in addition to the Chief of the Division, has 14 permanent employees.

The Forest Products Laboratories are under a Superintendent with 31 technical and 18 non-technical employees.

During the summer usually about 25 men, chiefly forestry students, are employed on research and stock-taking surveys.

The total staff of the Forest Service consists of 572 people, of whom 383 are employed throughout the year and 189 seasonally; 51 are technically trained foresters and 21 engineers of various kinds.

National Forests.—Each important National Forest, or, in some cases, a group of forests, has a resident Supervisor, technical and clerical assistants, and ranger staff. They provide quite intensive fire protection, construct and maintain permanent improvements, such as roads, trails, telephones and lookout towers, supervise the disposal of timber under permits or timber sales, and of grazing and hay, and facilitate the use of the forests for recreational purposes. Some planting of understocked areas is done, and nurseries are maintained on some of the forests. Considerable research is carried on under instructions from Head Office which ensure uniformity of methods. Working plans are being developed, and the forests are being placed under systems of management which, while permitting the use of the resources, is increasing their productive capacity. Many of these forests had suffered severely by fire before they were reserved and it will take some time to bring them back to full production.

Fire Protection.—Outside of the National Forests, special staffs are organized under the District Inspectors to protect the forests from fire. Owing to the immense area to be covered, this service is necessarily not so intensive as on the permanently dedicated areas.

Aircraft are depended upon for detection of fire in Manitoba and the northeastern part of Saskatchewan and on the eastern slope of the Rocky mountains in Alberta. In the former region, where there are numerous lakes, flying boats are used; these also assist in suppression by transporting rangers and fire-fighting equipment to the fires. In Alberta, land machines have to be used and there are few safe landing places, so their use is confined to the detection and

inspection of the fires. The aircraft are equipped with wireless, and report fires as soon as observed. This branch of the service is operated by the Directorate of Civil Government Air Operations of the Department of National Defence, and patrols are made as weather conditions demand, under the direction of the District Forest Inspectors. In the other parts of the Dominion lands, lookout towers or cabins are used for detection. Almost every form of transportation, including motor cars, horses, motor-boats, and canoes, is used for patrol and fire-fighting. Portable power and hand pumps are used extensively and have proved most effective in combating fires.

Certain officers of the Forest Service are appointed by the Board of Railway Commissioners to represent that body in the prevention and control of railway fires.

Tree-planting Division.—Since 1901 the Forest Service has been promoting the planting of shelter-belts and woodlots on the prairie farms by furnishing free planting stock and expert advice to the settlers. The main nursery and experimental station is at Indian Head, Saskatchewan, and a branch nursery is located at Sutherland, near Saskatoon, Saskatchewan. Species of trees suitable for prairie conditions are grown at the nurseries and distributed in the form of seedlings, cuttings, and young transplants. The success of this project is largely due to the system of personal inspection followed. Applicants for trees are required to prepare the soil in advance, and tree-planting promoters inspect the proposed site and plan the location and arrangement of the plantation to suit the local conditions. The planting stock is supplied free, but the recipients pay the transportation charges. The farmers agree to plant and care for the trees according to the instructions, and annual inspections are made by the promoters until the plantations are established. Over seven million trees are now distributed annually, and since the beginning of this work 100,000,000 deciduous trees and 1,500,000 conifers have been supplied to the settlers.

Forest Planting.—In the National Forests natural reproduction is depended on almost entirely, but in some situations artificial regeneration has been resorted to, chiefly for experimental purposes, and about 400 acres have been planted. In the past the greater part of the stock was supplied from the Indian Head nursery, but local nurseries are now being established in the National Forests.

Forest Resources.—All available information concerning the forest resources of the Dominion is compiled and revised from time to time. In co-operation with the Bureau of Statistics, information is collected and published annually concerning the wood-using industries. Data as to the depletion of the forests due to utilization, fire, insects, and decay are also collected. Trade statistics relating to forest products are compiled from data furnished by the Department of Trade and Commerce.

Surveys.—During the summer, survey parties under technical foresters, manned largely by students from the colleges of forestry, are engaged in mapping and estimating the timber on Dominion lands. These surveys are of four classes, depending on the object in view.

Reconnaissance surveys, which are the least intensive, are conducted for the purpose of obtaining a general idea of the area in order to determine the use to which it is best adapted and the method under which it should be administered. A rough estimate of the forest resources is secured.

Stock-taking surveys provide a fairly accurate estimate of the present stand of merchantable timber and the possibilities of future production. They provide also a basis for extensive administration on comparatively large areas.

Timber-sale surveys provide an accurate estimate of the merchantable timber, usually on comparatively small areas, for the purpose of determining the conditions under which the timber may be sold.

Working-plan surveys are the most intensive. In addition to an accurate inventory of the mature stand, the composition and extent of the young growth and also of the rate of increment is secured, so that the forest can be managed on a sustained-yield basis. This class of survey is confined to the National Forests. These surveys are conducted by the District Forest Inspectors in accordance with uniform instructions issued from the Head Office.

Silvicultural Research.—Studies of the silvicultural characteristics of the various species, the rate of growth, and the best practicable means of securing sustained yields of the most valuable species are being conducted not only at the Forest Experiment Station at Petawawa, Ontario, but also in the National Forests, and on numerous other experimental areas throughout the Dominion in co-operation with the provincial forest services and private companies. Accurate methods of measuring standing timber and of preparing volume, growth, and yield tables are being developed.

Silvicultural Advice.—A technically trained forester at Head Office is available to farmers and owners of woodlots and shade trees, to give expert advice regarding the care of woodlots and shade trees, tree-seed collection, and afforestation. The identification of tree material and the preparation of literature of a popular and educative nature regarding Canadian trees are also part of his duties.

Forest-products Research.—Three laboratories for conducting forest-products research are maintained. The main laboratory is in Ottawa, where timber testing, timber physics, wood pathology, and wood preservation are studied. The Pulp and Paper Division is located in Montreal, and is carried on in co-operation with the Canadian Pulp and Paper Association. A branch laboratory at Vancouver, British Columbia, specializes in western problems. These laboratories investigate the physical and chemical properties of the various species of wood and

their adaptability to industrial use, the most economical and efficient methods of manufacture and utilization, the elimination of waste, and the prevention of decay.

Recruitment and Training.—All appointments to the Forest Service, except those of labourers and temporary patrolmen who are employed for less than six months, are made by the Civil Service Commission. Vacancies are advertised publicly, and applications, giving full details, are submitted by the applicants. When considered necessary, competitive examinations, partly oral and partly written, are held at convenient points. Applicants must be British subjects and residents of Canada for at least three years. Technical foresters are required to have graduated from a course in forestry at a college or university of recognized standing, or to have had equivalent training and experience. In the Forest Service they are recruited for the most part from the Canadian universities. Permanent non-technical field employees, such as rangers, foremen, and grazing assistants, are required to have had practical experience in work connected with forestry or grazing, or some forest industry, to have good physique, and education sufficient to enable them to carry on the ordinary administrative work of the Service, keep records, and make the necessary reports. Undergraduates in forestry are given employment on surveys during their summer vacations, and thereby acquire valuable practical experience.

Publications and Reports.—The Director of Forestry publishes an annual report dealing with the various phases of the work of the Service. Bulletins of a technical, popular, or educative nature are published from time to time.

From 1908 to 1917, the Forestry Branch of the Department of the Interior (now known as the Forest Service) published annual reports on the production of the lumber and pulp and paper industries, and special reports on other forest products. Since 1917, the collection and publication of these forest-products statistics has been carried on by the Bureau of Statistics, Department of Trade and Commerce, in co-operation with the Forest Service.

A list of publications available for distribution by the Forest Service will be found in the Appendix.

Income and Expenditure.—During the fiscal year 1926-1927, the income of the Forest Service was \$223,914, derived from the following sources:—

National Forests—		
Sale of timber.....	\$	144,920
Grazing and hay.....		28,142
Other revenue.....		10,607
		<hr/>
	\$	183,669
Tree seeds and nursery stock.....		15,633
Miscellaneous.....		840
Forest-protection assessment.....		23,772
		<hr/>
		233,914

The expenditure amounted to \$1,317,148, under the following heads:—

Administration—		
Head Office.....	\$	51,932
Field.....		215,756
		<hr/>
		267,688
Forest Protection—		
On National Forests.....		364,936
Outside National Forests.....		352,871
Publicity.....		31,253
Insect Control.....		968
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		750,028
Surveys, research, and economics.....		76,781
Seed-collection, nurseries, and tree planting.....		97,102
Forest Products Laboratories.....		125,549
		<hr/>
	\$	1,317,148

The reasons for such a small revenue, as compared with the expenditure, are that the revenue from the timber licences, even in the National Forests, which amounted to \$1,058,133, is collected by the Timber and Grazing Lands Branch; a large proportion of the unlicensed timber in the National Forests is in the younger age-classes and will not be available for use for some years; the cost of protection on Dominion lands outside of the National Forests is, except for the one-half assessment on licensed lands, assumed by the Government; and publicity, tree planting, silvicultural and forest-products research, and other investigative work are conducted for the public benefit.

In addition to the Forest Service expenditure for fire protection, the expenditure of the Department of National Defence for air operations in connection with forest protection in the Prairie Provinces is approximately \$373,000, and the protection services of the Canadian National Parks Branch, the Board of Railway Commissioners, the Department of Indian Affairs, and the Northwest Territories Branch bring the total spent annually by the Dominion Government on protection to about \$1,270,000.

Timber and Grazing Lands Branch

This branch of the Department of the Interior administers the timber, grazing, and hay cutting on Dominion lands outside of National Forests in the provinces of Manitoba, Saskatchewan, Alberta and British Columbia. It also administers these matters on lands within National Forests for which licences or permits were granted prior to establishment of these reserves. The branch is organized under a Controller at the head office at Ottawa. For the general administration of Dominion lands the territory has been divided into twelve districts in each of which there is a Dominion Lands Agent. At Winnipeg there is a special Crown Timber Agent who is directly under this branch, but in the other agencies the Land Agents

act as Crown Timber Agents. The Assistant Commissioner of Dominion Lands, Western Service, with headquarters at Edmonton, supervises the work of the Crown Timber Agents. Timber Inspectors attached to the local agencies inspect the timber operations within their districts, and Appraisers of Grazing Lands conduct the field investigations in connection with grazing and hay cutting.

The timber on Crown Lands is disposed of by this branch under licence and permit berths, which are granted, respectively, by public competition and by permits to settlers and others without competition for small amounts of saw material, poles, fuel, etc.

Owing to the fact that the duties of the officials of this branch are involved with those of other branches, it is impossible to segregate the expenditure of this branch. The revenue collected by the branch in the fiscal year 1926-7 was \$1,217,914, of which \$1,058,133 was secured from timber in the form of bonuses, royalty, rental, and permit fees, and the balance from grazing, hay permits, assignments, seizures, etc.

The staff of this branch is recruited under the Civil Service Commission as in the Forest Service. The Timber and Grazing Lands Branch does not employ any technically trained foresters.

National Parks Branch

The National Parks of Canada are eighteen in number and cover an area of more than 11,000 square miles. Eight of the parks are scenic reserves, four are animal parks, three are recreational areas, and three historic sites. Seven are situated in Alberta, four in British Columbia, two in Saskatchewan, two in Ontario, two in New Brunswick, and one in Nova Scotia.

These national reservations were set aside by Acts of Parliament for the people of Canada. All natural resources are conserved within these areas; land is leased but not sold; development is subject to Government supervision; wild animals, fish, birds, and flora are all rigidly protected by an administration which has local resident superintendents and staffs, with head offices at Ottawa. Fishing in the parks is permitted in certain seasons, but hunting is absolutely forbidden. All visitors carrying firearms must have them sealed on entry and they must remain sealed until departure from the park. A comprehensive development program is conducted by parks officers, which includes construction, maintenance, and fire protection.

Jasper National Park, with an area of 5,380 square miles, is the largest park, although Rocky Mountains Park, with headquarters at Banff, and an area of 2,751 square miles, is the oldest. Both are famous as holiday resorts, Banff being already noted as a winter-sports center. Kootenay park is a scenic reserve bordering the Banff-Windermere Highway. Yoho, Glacier, Mount Revelstoke, and Waterton Lakes parks are all mountain playgrounds possessing some of the most magnificent scenery to be found in the entire world. Rocky Mountains, Yoho, and Kootenay parks are linked with an excellent system of highways composed of the Banff-Lake Louise Highway, the Banff-Windermere Highway, and the Kicking Horse Trail. The latter two are transmontane motor ways across the central Rockies.

Buffalo and Elk Island parks are primarily buffalo reserves, but deer, elk, and moose are also in the reserves. These parks were established to provide accommodation for the original nucleus of the present great buffalo herds bought from Michael Pablo, of Montana, in 1907. At present there are 2,421 buffalo in Buffalo park and 726 in Elk Island. In Buffalo park, officials of the Department of Agriculture are now carrying on experiments in crossing the buffalo with domestic cattle and yak with a view to producing a new range animal possessing the rustling qualities and hardiness of the buffalo and the beef qualities of the domestic cattle.

Nemiskam park is an antelope reserve where Canada's efforts in the conservation and propagation of this species have been very successful.

Three hundred and sixty-six miles of first-class motor roads are at present in use within the parks. A total trail mileage of 1,904.5 is maintained, by which many points of interest are made accessible to visitors and the warden service is facilitated in their ranging and fire-protection duties. Telephone lines totalling 703.5 miles have been built, which includes the systems in townsites and the forest lines used by wardens.

Saskatchewan now has a large recreational area and wild life sanctuary in the recently established Prince Albert park, which has an area of 1,377 square miles. This park contains some of the finest recreational and scenic territory to be found in the province. In Ontario, Point Pelee park is a bird sanctuary and recreational area, while the St. Lawrence Islands park is maintained solely for recreational purposes. The three parks in the Maritime provinces are Historic Sites.

Board of Railway Commissioners

Fire Inspection Department.—Ninety-seven per cent of the 41,000 miles of steam railway in Canada is subject to the jurisdiction of the Board of Railway Commissioners. Lines not so subject are those operated under Provincial charters, or owned and operated by a Provincial Government under other than a Dominion charter.

On railway lines subject to the Board's jurisdiction, the measures to be taken by the companies for the prevention and control of fires presumably due to railway agencies are prescribed in the Railway Act and in General Order No. 362 of the Board. These requirements are, briefly, as follows:

(a) Railway rights of way must be maintained free from all unnecessary combustible matter. Cuttings, dry grass, and other inflammable debris are generally burned early in the spring or late in the fall. The time when fire may be used for this purpose and the precautions to be taken to prevent its spread are regulated by local officers of the Fire Inspection Department of the Board, by the issuance of permits to burn. Such local officers may prohibit all burning operations when weather conditions render the use of fire unsafe. Ordinarily, railway rights

of way are 100 feet in width, that is, 50 feet on each side of the centre of the main track. On a comparatively small mileage, the right of way is double this width. Steady progress is being made towards better conditions on rights of way through forest sections. The effectiveness of this work is greatly reduced by the presence of logging slash and other inflammable debris on lands immediately adjoining rights of way. This constitutes a very serious problem in the control of fires originating on or near the railways. A beginning toward the solution of this problem on outside lands has been accomplished, through Provincial Forest Services, acting under Provincial legislation.

(b) Efficient spark-arresters and other fire-protective appliances must be maintained on all coal-burning locomotives. Railways are required to make weekly inspections of such appliances and to hold defective locomotives out of service until repairs have been made. Intensive check inspections of fire-protective appliances are made by the Board's Inspectors.

(c) The dumping of fire, live coals, and hot ashes upon the right of way is prohibited unless the burning material is immediately extinguished.

(d) The use of dangerous classes of locomotive fuel is prohibited, unless locomotives are equipped with special spark-arresting devices approved by the Board.

(e) To reduce the danger of fires being set along the railway, by burning smoking-materials thrown by passengers from trains, railways are required to post warning notices in cars where smoking is permitted, and trainmen issue verbal warnings to passengers in addition.

(f) The danger of fires in prairie sections of the Prairie Provinces is greatly reduced by the ploughing of fireguards along railway lines in accordance with requirements prescribed by the Chief Fire Inspector of the Board.

(g) The Chief Fire Inspector is authorized to prescribe the establishment of special fire patrols by railway companies through forest sections. Under this requirement, the services of nearly 900 special fire patrolmen in railway employ are available when required, on some 7,200 miles of line where the fire-hazard is high. On 6,200 additional miles of line through forested territory where the fire hazard is not extreme, fire-protection work is handled by section forces and other employees, as a part of their regular duties.

(h) Railway companies are required to instruct section-men, agents, contractors, trainmen, and other regular employees relative to the reporting and extinguishing of fires occurring within 300 feet of the track, unless proof shall be furnished that such fires were not caused by the railway.

(i) Each railway company is required to submit a report to the Board with respect to every fire which burns over more than 100 square feet outside the right of way in what is classified as a forest section. These reports are checked and supplemented by reports from officers of the Fire Inspection Department.

The fire-protection work of the railway companies is supervised by the field staff of the Fire Inspection Department of the Board. This staff is not a special set of men employed by the Board, but is made up of employees of the various forestry and fire-protective organizations of the Dominion and Provincial Governments, such employees being appointed officers of the Board under a co-operative arrangement established immediately after the issuance of the Board's fire regulations in 1912. This plan has for the most part worked out admirably. The railway companies have, with few exceptions, co-operated efficiently, and the fire loss due to railway causes has decreased to such an extent that the railways have now become minor, instead of major, agencies in causing loss by forest fires. In many cases, the railways have been effective in checking fires which came from a distance, and for the origin of which they were in no wise responsible.

During the five-year period, 1923 to 1927 inclusive, the railways were charged with 14.8 per cent of the total number of fires reported as occurring in forest territory. Of these, only half reached a size of one-fourth acre or more, the other half being incipient and causing no damage. Fires attributed to railway agencies during this period accounted for only 4.5 per cent of the total area burned over by fires due to all causes throughout the Dominion.

BRITISH COLUMBIA

The Department of Lands, under the Minister of Lands and the Deputy Minister of that department, administers the natural resources of this province in connection with provincial land, forest, and water. The Forest Branch, as a part of this Department, is the Forest Authority of the province. This branch, under a Chief Forester and Assistant Chief Forester, has seven main divisions, namely, Management, Operation, Research, Forest Surveys, Grazing, Finance, and Trade Extension. Each division is normally in charge of a superior officer with the necessary technical, clerical, and stenographic personnel.

The above organization at Victoria has under its direction a permanent staff of nearly 200 scattered throughout the six forest districts into which the province has been divided for the purpose of administration. Each district is in charge of a District Forester and an Assistant District Forester, under whom works a staff of rangers and others. In the fire season over 200 assistant rangers, patrolmen, and lookout men are employed in addition.

Technical foresters are required to be graduates of recognized forest schools. Undergraduates are given summer employment wherever possible.

The ranging and scaling staff are selected by competitive examinations under the Civil Service Commissioner. Assistant rangers must pass a special departmental examination, where experience in woods work and physical fitness are among the qualifications required. Co-operation with industries and development of policies are assisted by advisory joint committees on the export of raw materials, the scaling of timber, and the protection of the forests from fire.

The main efforts of the Forest Branch have been directed towards the protection of the forests from fire and the business administration of the forests, but research work is now being conducted as funds and trained men become available.

Income and Expenditure.—The forest revenue in British Columbia in 1926 was \$4,484,870, and the expenditure in the fiscal year 1926-27 was \$1,521,820, leaving a net revenue of nearly \$3,000,000.

<i>Revenue</i>	
Licence fees, and rentals.....	\$ 1,191,278 00
Royalty.....	1,780,997 00
Timber-sale, stumpage, etc.....	601,535 00
Trespass penalties.....	11,677 00
Miscellaneous.....	4,995 00
Taxation private forest land.....	410,684 00
Grazing fees.....	12,329 00
Forest-protection tax.....	335,409 00
Scaling fund.....	135,966 00
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	\$ 4,484,870 00
<i>Expenditure</i>	
Salaries.....	\$ 231,885 00
Expenses.....	139,260 00
Lumber-trade extension.....	12,524 00
Reconnaissance.....	22,171 00
Insect control.....	14,957 00
Research.....	13,965 00
Forest reserves.....	52,966 00
Grazing-range improvement.....	6,150 00
Forest fire protection.....	887,528 00
Scaling fund.....	140,289 00
Contingencies.....	125 00
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	\$ 1,521,820 00

ONTARIO

The Department of Lands and Forests is presided over by a Cabinet Minister with four divisions under Deputy Ministers, namely, Lands and Forests, Forestry, Northern Development, and Surveys.

Forest administration is carried out through the Department of Lands and Forests controlling timber sales, and the Forestry Department having charge of Reforestation, Protection, Air Service, Forest Surveys, and Investigations.

The head-office staff of the Forestry Department comprises a Deputy Minister of Forestry and Provincial Forester, Assistant Provincial Forester, four Foresters in charge respectively of Forest Protection, Forest Surveys and Investigation, Reforestation, and Air Operations (mapping and photography) and a Director of Air Operations, five Assistant Foresters, and a clerical staff.

The northern or forest region of the Province is organized into eleven districts with foresters in charge. The permanent field staff consists of 10 foresters, 7 assistant foresters, 5 forest inspectors, and 12 chief rangers. The temporary field staff comprises 25 chief rangers, 114 deputy chief rangers, 2 locomotive inspectors, and 1,000 fire rangers, lookout men and boat and car engineers. From 20 to 30 forestry students are used each season in field-work on forest surveys.

The permanent field staff on Reforestation includes three foresters in charge of forest nursery stations, with a total staff of about 40. The temporary staff employed during the active season averages about 400 men.

The permanent technical staff totals 35 and includes graduates of Toronto, Yale, Michigan, and Harvard universities.

The Forestry Board, which was created by legislation in 1926, functions in an advisory capacity. It is composed of five members, three representing the forest industries, one the Faculty of Forestry of the University of Toronto, and the Deputy Minister of Forestry.

Timber Sales.—The administration of timber sales under the Deputy Minister of Lands and Forests involves preparation of estimates for sales, inspection of logging operations, measurement of timber for collection of dues, trespass, and adjusting settlers' timber rights.

The head-office staff comprises the Deputy Minister of Lands and Forests and a clerical staff of 15 officers.

The permanent field staff consists of twelve Crown Timber Agents with 24 forest rangers. The temporary field staff consists of 150 scalers and forest rangers. Timber scalers receive licences after passing government examinations. The rangers are woodsmen usually with logging experience.

Forest Protection.—A patrol system was inaugurated in 1885, and has been gradually developed until Ontario has one of the best organized and equipped protection services on the continent. The main features of the system are the establishment of a close season during which permits are required for setting out fires and for travel in the forest, aerial patrol by 23 sea-planes, ground patrol by a thousand rangers provided with means of transportation such as motor boats, motor trucks, railway speeders, canoes, etc., and with portable power and hand pumps, hose, shovels, etc., the erection of 177 lookout towers with telephone connections; inspection of locomotives, and publicity.

Reforestation.—Three provincial forest stations have been established in the southern portion of Ontario for the production of nursery stock and the development of demonstration plantations and forests. At St. Williams, in Norfolk county, is the oldest forest nursery station, consisting

of 3,300 acres (established in 1909). The nursery portion of this station comprises 140 acres, the remainder being natural woodlands and demonstration plantations. The principal species used are white, red, jack, and Scotch pines, white and Norway spruce, and European larch. In 1922, two new stations were established along the above lines, one of 150 acres at Orono in Durham county, and the other of 1,200 acres at Midhurst in Simcoe county. These provincial forest stations have at present an output of over 10,000,000 plants with new seed-bed developments which will increase the production to 15,000,000 plants within two years.

Demonstration plantations are being made through the northern districts on denuded Crown lands. Last season 255,000 trees were planted in these projects. Reforestation on private and municipal projects are assisted. The rapid development of reforestation has presented the problem of securing forest-tree seed. To meet this demand a curing and extracting plant has been established at Angus, Ontario. At this point the Department maintains drying sheds with a capacity of 10,000 bushels of cones and a storage vault capable of holding 25,000 pounds of seed. During the past season 6,000 bushels of cones were handled at this plant.

Forest Surveys.—A forest map of the Province is in progress, to show types, age-classes, and conditions. To date the area typed is 30,605 square miles; area typed and estimated 51,420 square miles; total, 82,025 square miles.

Forest Investigation.—Growth, increment, and pathological investigations are conducted.

Income and Expenditure (1926)

Revenues as follows:—	
Timber dues or royalties.....	\$ 2,335,941 32
Stumpage bonuses.....	1,381,053 59
Licence fees and ground rent.....	141,573 54
Forest protection tax.....	306,119 51
Miscellaneous.....	105,810 78
Total.....	\$ 4,270,498 74
Expenditures as follows:—	
Administration.....	611,699 12
Forest Research.....	10,000 00
Fire protection.....	992,860 73
Reforestation.....	206,335 29
Total.....	\$ 1,820,895 14

QUEBEC

Forest Service.—The Department of Lands and Forests of the provincial Government administers the timber in the province. In 1909, a Forest Service was created in this Department and given charge of the timber-lands and matters relating to forestry. It is organized under the Chief of the Forest Service and the Assistant Chief. The staff consists of some thirty forest engineers and a non-technical field force of 255 rangers and cullers. The Forest Service has charge of the exploration of unsurveyed territory in the province, the classification of soils, the supervision of lumbering operations on Crown lands, reforestation, and all other technical work of the Department in connection with forests. The School of Forestry, the School of Forest Rangers, and the School of Paper-making are supported by the Forest Service.

Forest Protection Service.—In 1924 the Government instituted a special Forest Protection Service to take charge of fire protection and suppression. This Service patrols the Crown lands, the Provincial Parks, and all the private lots of the settlers, and has supervision over the protection on licensed lands. Every licensee is required from early spring to late fall to have his limits patrolled by a competent staff of rangers, paid and selected by him, but appointed by the Minister of Lands and Forests, and the latter may prescribe the necessary personnel.

Since 1913, many timber-limit holders in three districts have formed Associations for the purpose of securing an adequate protection against forest fires, but some large timber companies maintain their own patrol. These licensees and the Associations conduct their protection operations on a co-operative basis with the Forest Protection Service. Every year they must submit their plans of organization to the Forest Protection Service for approval. In 1926-7, the Forest Protective Associations of Quebec spent \$619,700 and the Government \$430,000.

For forest-protection purposes, the province has been divided into eleven districts. The fire-fighting force numbers not less than 4,000 Inspectors and Rangers every year. The Chief and Assistant Chief of the Forest Protection Service are the authorized representatives of the Board of Railway Commissioners and of the Public Utilities Service.

A close season is established between April 1 and November 15, during which permits must be secured for slash-burning all over the Province. Legislation has been passed requiring all persons who wish to travel in the forest between April 1 and November 15 to secure permits issued by the Forest Protection Service.

Eleven Meteorological Stations have been modernly equipped to study relative humidity and its relations to forest-fire hazards.

The activities of the Forest Protection Service include the extension of telephone lines throughout the forests, the organization of patrols, the construction of trails through the forests, the installation of permanent lookouts, and the issuing of permits for burning and travel in the forests. Press campaigns and lecture tours are conducted in co-operation with the Canadian Forestry Association and *La Forêt et la Ferme*. Thousands of posters are posted at appropriate places, and a special calendar of the Department of Lands and Forests is distributed throughout the province. Aerial patrol is conducted from a hydroplane station at Roberval in the Lake St. John district.

The expenditure of the Department of Lands and Forests in the fiscal year 1926-27 was as follows:—

General Expenditure.....	\$	75,000	
Surveys.....		400,000	
Forestry Service and Inspection of Lands.....		325,000	
Protection of Forests.....		430,000	
Hydroplane Service.....		250,000	
Berthier Nursery Maintenance.....		25,000	
Reforestation.....		52,558	
Forest Research Promotion Act—			
School of Forestry.....	\$	15,000	
School of Forest Rangers.....		11,645	
School of Paper-making.....		26,770	
			53,415
	\$		1,610,973

Most of the items for surveys and some of the general expenditure is chargeable to land rather than to forest administration, so the total forest expenditure can be placed at about \$1,250,000.

The forest revenue for the same period was as follows:—

Ground Rent.....	\$	775,221	
Stumpage dues.....		3,701,451	
Stumpage bonuses.....		996,295	
Penalties and interest.....		228,139	
Transfer fees.....		55,910	
	\$		5,757,016

Other sources of revenue brought the total revenue of the Department of Lands and Forests to \$6,601,146.

The recruitment and training of superior officers is through the School of Forestry, which is affiliated with Laval University. Students of the School are employed during the summer months. Rangers and cullers are appointed on practical qualifications with statutory examination in some cases. Additional training is afforded by the School of Forest Rangers.

The Minister of the Department publishes an Annual Report containing the Report of the Chief of the Forest Service. The provincial Bureau of Statistics publishes a Statistical Year Book containing forest statistics and information concerning provincial forestry matters furnished by the Forest Service.

NEW BRUNSWICK

The forest administration is under the Minister of Lands and Mines. The Deputy Minister, who is the permanent head of the Department, is a graduate of the New Brunswick Forest School and was formerly Chief Forester. The Forest Service has charge of the administration of the forests on Crown lands, fire protection, and the fish and game in the forests. The head-office staff consists of a Chief Forester, Assistant Forester, Chief Game Warden, Chief Scaler, and Forestry Assistants. Control of game protection, measurement of timber, and fire protection is carried on by a permanent staff of forest rangers supplemented by seasonal game wardens, scalers, patrolmen, lookout observers, etc.

The forest is one of the chief sources of revenue in New Brunswick. During the fiscal year ending October 1, 1926, this amounted to \$1,097,402, and the expenditure of the Forest Service was only \$167,340.

The revenue was derived from the following sources:

Royalty on timber cut.....	\$	765,145	
Stumpage bonuses.....		33,879	
Annual rentals.....		86,036	
Miscellaneous timber revenue.....		17,962	
Wild land tax.....		57,435	
Forest-protection tax.....		33,861	
Fish and game.....		103,084	
	\$		1,097,402

The expenditure is divided under three headings:—

Scaling and stumpage collection.....	\$	54,227	
Forest fire protection.....		48,238	
Game protection.....		64,875	
	\$		167,340

The New Brunswick and Nova Scotia forest services are the only forest authorities in Canada which have control of the fish and game and include these resources in their revenues and expenditures. Exclusive of game and fish, the forests yield New Brunswick a net revenue of about \$900,000.

NOVA SCOTIA

The Attorney General of the province is also the Minister of Lands and Forests, and he is responsible for the management, leasing, sale, or other disposition of the Crown Lands, the surveying and recording of all forest and wild lands, the conservation and protection of all forest and timber lands, whether the same are Crown lands or privately owned, and the protection, preservation, and propagation of game and game fish.

Under the Minister, the Chief Forester has charge of the forest protection, surveying, and scaling.

The province is divided into eight chief-forest-ranger districts, each district comprising about 3,000 square miles. The Chief Forest Rangers are experienced woodsmen who, for a number of years, have been occupied in the lumbering business as superintendents and chief scalers. During their term of office they receive considerable training in surveying, cruising, and general forestry.

Each Forest Ranger District is divided into from eight to ten sub-ranger sections, each section comprising from thirty to fifty square miles. The sub-rangers are practical woodsmen, recruited from the ranks of camp foremen, scalers, or guides.

The Department operates a forest nursery at Lawrencetown, managed by a technically trained forester, who has also charge of the reforestation work throughout the Province.

The Department issues an Annual Report and has issued a bulletin for the treatment of the farmer's woodlot, and a bulletin for instructing the school teachers and older pupils in forestry.

The revenue and expenditure of the Department in 1926 was as follows:—

Revenue	
Royalty, dues and stumpage bonuses.....	\$ 5,934 91
License fees and ground-rent.....	14,525 51
Land tax on privately owned timber-land.....	175,059 94
Trespass penalties.....	5,846 41
Forest Protection tax.....	39,924 94
Grazing fees.....	
Fish, game and fur.....	32,249 67
All other revenues.....	937 89
	\$ 274,478 77
Expenditure	
Administration.....	\$ 12,000 00
Fire protection.....	67,254 43
Investigation and research.....	2,090 83
All other expenditure.....	39,476 04
	\$ 120,821 30

FOREST REVENUE AND EXPENDITURE IN CANADA

The various governments of Canada, Dominion and Provincial, secure annually a direct revenue of \$17,000,000 from the forests, exclusive of the revenue from fish and game, and over \$7,000,000 is spent by the various forest authorities in administering, protecting, and developing the forest resources.

The revenue was derived from the following sources in 1926:—

Royalty.....	\$ 9,180,639
Stumpage bonuses.....	3,196,137
Ground rental.....	2,572,351
Penalties, interest, etc.....	270,591
Scaling fees.....	151,817
Taxation of private lands.....	643,179
Grazing fees.....	40,471
Forest-protection tax.....	739,088
Miscellaneous.....	212,696
	\$ 17,006,969

The expenditure was divided as follows:—

Administration.....	\$ 2,622,643
Investigation and research.....	250,556
Fire protection.....	3,695,880
Reforestation.....	363,379
Trade extension, education, etc.....	144,265
	\$ 7,076,723

Forest Revenues and Expenditure

Authority	Revenue	Expenditure
Dominion.....	\$ 1,258,035	\$ 1,909,748
British Columbia.....	4,484,870	1,521,821
Ontario.....	4,270,500	1,810,895
Quebec.....	5,757,016	1,610,973
New Brunswick.....	994,319	102,465
Nova Scotia.....	242,229	(a) 120,821
	\$ 17,006,969	\$ 7,076,723

(a) Partly game and fish.

The contributions of the timber owners towards fire protection are included in the revenue except in Quebec, where they provide their own protection through their protective associations. These associations in Quebec spent \$619,700 in 1926. The railway companies also spend a large amount estimated to be at least \$500,000 annually in protecting the forests along their lines. The total amount spent on fire protection in Canada in 1926 is estimated to be \$4,815,000, of which \$2,955,000 was contributed by the various governments and \$1,860,000 by the timber owners and railways.

The amount spent on forestry education in British Columbia, Ontario, and New Brunswick is not included in the above figures, but the Department of Lands and Forests in Quebec has included \$53,415 granted to the various forestry schools in its expenditure.

The Canadian Forestry Association spent \$71,247 in addition to the governmental grants on educating the public along forestry lines. Many timber owners provide additional fire protection, notably the logging operators in British Columbia and the private timber owners in the Maritime Provinces. Several of the pulp and paper companies are carrying on research projects, and a few are doing some artificial reforestation. Including education and all private and governmental expenditure, there is being spent annually in Canada over \$7,500,000 for forestry purposes.

8—Municipal and Private Forestry Activities

The abundance of cheap and accessible timber and the conditions of tenure under which over ninety per cent of the forest land is owned by the Crown in the right of the dominion or provincial Governments have been retarding factors in the development of municipal and private forestry in Canada.

In the settled districts of eastern Canada nearly all of the farms have woodlots, which supply a large proportion of the fuel used by the rural population. They yield also a considerable amount of timber for construction purposes and the wood-using industries. Maple sugar and syrup are also important products of these woodlots. The 1921 census showed that the forest products of the farms were valued at \$72,000,000. The direct benefit of these forests to agriculture in the conservation of water, protection to stock and crops from the sun and wind, and the amelioration of climatic extremes are undoubtedly of greater value even than the wood produced.

On the whole these woodlots have received very little silvicultural attention and have deteriorated to such an extent that their productiveness is far below what it might be.

The exceptions to this rule have proved that there is no part of the farm which yields a higher financial return with such a small amount of labour and expense. A recent survey of the fuel situation in Ontario revealed the fact that the districts which had the best-kept woodlots were invariably the most prosperous agriculturally.

For some years, Ontario and Quebec have been encouraging and assisting the development of farmers' woodlots by furnishing expert advice and providing planting stock, either free or at nominal prices. New Brunswick and Nova Scotia are now following a similar course.

The development of this project in Ontario is indicated by the fact that in 1905, when the distribution of nursery stock was started, 10,000 trees were sent out. In 1910 the number had grown to 500,000, and in 1927 had reached 7,000,000.

With the assistance of the Forestry Department in Ontario, fifty municipal and township forests and eight county forests have been established in the last few years, and it is anticipated that the number and size of these forests will steadily increase as the public becomes aware of the advantages to be gained.

In Quebec, 45 township forests, aggregating 411,765 acres, have been established under the control of the provincial Forest Service.

In the Prairie Provinces, the Tree-planting Division of the Dominion Forest Service has been supplying planting stock for shelter-belts and woodlots since 1901, and to date 100,000,000 seedlings and cuttings have been furnished free of charge. In 1927, over 7,500,000 trees were distributed to 5,923 applicants, and the demand is increasing steadily. As a result of the system of personal inspection, these plantations have been remarkably successful, and have done much to improve the condition of the prairie homes. Though the object of the plantations is primarily for protection against the wind, some of the older plots are now providing a limited amount of wood which is most useful on a prairie farm.

Few of the lumber operators have as yet attempted much in the way of forestry beyond fire protection, but nearly all the pulp and paper companies in Canada now have forestry departments in charge of technically trained men. Their work has been largely devoted to stock-taking, mapping, and the preparation of working plans. In some instances, the entire woods operations have been placed under the charge of foresters, and in others the foresters act in an advisory capacity as far as exploitation is concerned. Several of the pulp and paper companies are endeavouring to place their forests on a sustained-yield basis, and a few have undertaken artificial regeneration, maintaining nurseries and establishing plantations. The most noteworthy of these is the Laurentide Company, Limited, at Grand-Mère, Quebec, which has now twenty square miles under plantation and is extending these at the rate of from $3\frac{1}{2}$ to 5 square miles per year.

There is an increasing number of forest engineers who are employed by private interests to cruise and value their forest properties and, in some cases, to prepare working plans.

9—Professional and other Societies Interested in Forestry and the Utilization of Forest Products

CANADIAN SOCIETY OF FOREST ENGINEERS

This Society was established in 1908 as an organization of technical foresters. The following quotation from the constitution describes the objects and membership of the Society:—

The *objects* of this Society are:

- (1) To advance the members in the theory and practice of forestry by the discussion of technical and professional topics.
- (2) To promote a better mutual acquaintance among Canadian foresters and to cultivate an *esprit de corps* among the members of the profession.
- (3) To take such steps as may from time to time appear advisable for the purpose of promoting in Canada the interests of the forestry profession as a whole.

Membership

1. The membership of the Society shall be divided into five classes, viz., Honorary, Active, Associate, Student, and Non-Resident.

2. Honorary members shall be persons prominently connected with the forestry profession who shall be recommended by the General Executive Committee and elected by a majority vote of the active members at an Annual Meeting of the Society.

3. Active members shall be graduates of a school or college of forestry of recognized standing, who shall have been engaged in the practice or teaching of or research in some branch of forestry, for at least three years since graduation; or shall be men who, though not graduates of a school or college of forestry of recognized standing, have been engaged in the practice or teaching of or research in some branch of forestry for at least five years, during two of which the candidate shall have been an Associate member of the Society and who shall have submitted to the General Executive Committee, in the form of a thesis or a report of forestry work performed, evidence of sufficient technical knowledge to warrant his recognition as a professional Forest Engineer.

Active membership shall be granted only to residents of the Dominion of Canada, or to those who, while residing elsewhere, spend at least the major portion of their time in forestry work in Canada. Only active members in good standing shall have the right of voting and holding office.

4. Student members shall be Canadian students in attendance at a school or college of forestry.

5. Associate members shall be graduates of a school or college of forestry of recognized standing, or men who, while not graduates of a school or college of forestry of recognized standing have been engaged in the practice or teaching of or research in some branch of forestry for at least three years. Associate membership shall be granted only to residents of the Dominion of Canada or to those who, while residing elsewhere, spend at least a major portion of their time in forestry work in Canada.

6. Non-resident members shall possess all the qualifications for active membership except residence or the practice of forestry in Canada. Active members who do not reside in Canada, or may remove therefrom, shall be allowed the option of retaining their active membership or transferring to non-resident membership.

7. Candidates for membership must be proposed by an active member. The name shall be submitted by the member proposing the candidate for membership, to the Secretary, together with an account of the training, character, and work of such candidate. The name, together with the account aforesaid, shall be referred, first, to the District Executive Committee, and then forwarded by them to the General Executive Committee, all nominations whether approved or disapproved to be so forwarded to the General Executive Committee, with the judgment of the District Executive Committee, and, if approved by six members of the General Executive Committee, the candidate shall be declared elected a member of the Society in the grade designated.

8. For the purpose of this constitution, the term *forestry* shall be understood to include all those activities involved in the management of a forest, the object of which is to maintain the production of wood, or the beneficial influence of the forest."

The membership in January, 1928, included 6 honorary, 151 active, and 110 associate members.

The general Executive of the Society consists of B. F. Avery, Spanish River Pulp and Paper Mills, Sault Ste. Marie, Ont., president; A. H. Richardson, Ontario Forestry Branch, Toronto, Ont., secretary, and Clyde Leavitt, Board of Railway Commissioners, Ottawa, Ont., treasurer, and the chairmen of the District Executive committees.

The District Executive Committees are composed as follows:—

Quebec and Maritime Provinces—Ellwood Wilson, Laurentide Co., Ltd., Grand-Mère, Que., chairman; L. S. Webb, University of New Brunswick, Fredericton, N.B., and W. G. Wright, Price Bros. & Co., Roberval, Que.

Ontario—Roland D. Craig, Forest Service, Ottawa, Ont., chairman; Dr. J. H. White, Faculty of Forestry, University of Toronto, Toronto 5, Ont., and E. J. Zavitz, Deputy Minister of Forests, Toronto 5, Ont.

Prairie Provinces—C. H. Morse, District Forest Inspector, Calgary, Alta., chairman; D. A. Macdonald, Asst. District Forest Inspector, Winnipeg, Man., and N. M. Ross, Forest Nursery Station, Indian Head, Sask.

British Columbia—H. R. Christie, University of British Columbia, Vancouver, B.C., chairman; L. R. Andrews, Bloedel, Welsh & Stewart, Vancouver, B.C., and P. L. Lyford, Vancouver Block, Vancouver, B.C.

The official organ of the Society is the *Forestry Chronicle* which is published quarterly in Toronto. The Board of Publication consists of A. H. Richardson, Ontario Forestry Branch, Toronto, editor; Ellwood Wilson, H. P. Webb and Thomas Maher, representing Quebec and the Maritime Provinces; T. W. Dwight, W. M. Robertson and W. A. Delahey, representing Ontario; H. S. Holman, R. M. Watt and H. P. Eisler, representing the Prairie Provinces; and Adrian Thrupp, J. F. Alexander and H. R. Christie, representing British Columbia.

ASSOCIATION OF FOREST ENGINEERS OF THE PROVINCE OF QUEBEC

This association was founded in Quebec in 1916, obtained a legal status in March, 1921, and has a total membership of 99 engineers.

The aims and objects of this association are to safeguard public interests concerning the management of the forests in the Province of Quebec; to protect its members against the activities of other persons calling themselves "forest engineers," who have not the scientific training; to establish an esprit-de-corps among its members and to advance their standing by the discussion and publication of technical works.

Membership.—Any person applying for membership must be at least 21 years of age and a British subject, and must hold a diploma of a forest engineer from the Quebec School of Surveying and Forestry, or from any recognized university of the Province of Quebec, or prove his competence to the satisfaction of the Board of Examiners. This Board of Examiners consists of three members selected by the Board of the Association and two others named by the Director of the School of Surveying and Forestry.

Every year the association publishes a list of the persons who are qualified to act as forest engineers in the Province of Quebec.

Officers.—President, Henri Roy, Forest Service, Quebec; Secretary, L. Garneau.

CANADIAN FORESTRY ASSOCIATION

The Canadian Forestry Association was founded in 1900 as a propagandist institution to stimulate public interest in the forest resources, their protection from fire, and their rational management. The greater part of the Association's effort has been given to the subject of popular co-operation in reducing the fire hazard. To attain that end the educational methods have been localized as far as possible, each province and district receiving specific educational treatment based upon prevailing interest and attitudes towards the forest resources. Active friendly relationships are established between the masses of people and the cause of timber protection by presenting conservation as a matter of trade rather than trees; green forests as "green" communities; continuous timber production as continuous employment; in other words, associating forest perpetuation with the perpetuation of the human and personal interests of the citizens in all walks of life. Tree planting on the prairies and the care of the woodlots are also promoted.

At the present time, fourteen lecturers are used from spring to fall, utilizing railway lecture-cars and motor trucks equipped with electric generators and motion-picture projectors and films especially made by the Association. Other educational media are the magazines, *Forest and Outdoors* and *La Forêt et La Ferme*, both owned and edited by the Association; radio broadcasting; prepared lectures with travelling lantern-slide sets and motion pictures; a newspaper publicity bureau; instruction in more than 11,000 schools, and many other channels of dissemination. More than 1,600 public meetings were held by the Association in 1927.

The wide-spread influence of the Association is shown by the fact that the membership includes 28,000, and the income from all sources is \$137,000. Grants amounting to \$13,500 are made by the Dominion and Provincial governments; \$71,247 is furnished by voluntary private subscription, and the balance is secured from membership fees and the magazines.

The head office is at 51 Sparks Street, Ottawa, and branches are maintained at Vancouver and Montreal.

The officers of the Association for 1928 are:—

Patron: His Excellency the Governor General.

Honorary President: Rt. Hon. W. L. Mackenzie King.

Honorary Vice-President: Honourable Charles Stewart.

President: W. E. Golding.

Manager: Robson Black.

Publication Manager: George A. Mackie.

Assistant Manager: Gordon M. Dallyn.

British Columbia Manager: T. H. Wilkinson.

Treasurer: Miss M. Robinson.

Directors: 61 representing the various provinces, forest authorities, and industries in the Dominion.

ASSOCIATIONS OF MANUFACTURERS OF FOREST PRODUCTS

CANADIAN LUMBERMEN'S ASSOCIATION

Head Office: Fraser Building, Ottawa. Organized August, 1908. Number of members, 158.

Objects. (1) To promote the interests and conserve the rights of those engaged in lumbering operations, or in the manufacture, sale, or distribution of lumber; to protect its members against unbusinesslike methods in the wholesale and retail lumber trade; (2) To foster such trades, and reform abuses therein where they exist; (3) To secure freedom from unjust or unlawful exactions; (4) To diffuse accurate information among its members; (5) To secure uniformity in usage, custom, and trade conditions.

Officers.—President, Brig. Gen. J. B. White, Canadian International Paper Company, Montreal, Que.; 1st Vice-Pres., E. R. Bremner, Watson and Todd, Ottawa; 2nd Vice-Pres., G. P. Burchill, South Nelson, B.C.; Director-at-Large and Hon. Treas., R. G. Cameron, Ottawa; Secretary and Manager Transportation, R. L. Sargent, Fraser Building, Ottawa.

Two affiliated groups, the White Pine Bureau and the Hardwood Bureau, were organized in 1927 to promote their respective interests.

THE CANADIAN PULP AND PAPER ASSOCIATION

Head Office: 701 Drummond Bldg., Montreal, Que. Organized, 1913.

Member Companies.—21 Charter members; in 1927 this number had grown to 64, embracing practically all the important companies operating in Canada.

Objects.—(1) Gathering, compiling and distributing statistics relating to the industry; (2) standardization of production methods; (3) improvements of the technical side of the industry; (4) protection and perpetuation of the forests from which its raw material is drawn; (5) study of freight tariffs and other subjects affecting the welfare of its members; (6) encouragement of technical study among the industry's operatives and the promotion of efficiency in manufacturing methods; (7) surveying of imports and exports and other conditions tending to affect the industry's welfare; (8) advertising the products of its members and the promotion of the domestic and foreign demand for Canadian pulp and paper.

In order to facilitate the work of the Association some 15 sections have been organized.

The Technical Section devotes its attention to the technical problems of manufacture; the Research Section is especially interested in the Cellulose Institute established at Montreal and operated in co-operation with the Forest Service. Research is also conducted in the laboratories of many of the mills. The Woodlands Section covers forestry and logging operations. The other sections include the Newsprint, Sulphite Pulp, Mechanical Pulp, Wrapping Paper, etc.

Officers.—President, Col. C. H. L. Jones, Vice-President Spanish River Pulp and Paper Mills, Sault Ste. Marie, Ont.; Sec.-Treasurer, Edward Beck, 701 Drummond Building, Montreal, Que.

TIMBER INDUSTRIES COUNCIL OF BRITISH COLUMBIA

Head Office: 911 Metropolitan Bldg., Vancouver, B.C. Organized, January, 1921.

Membership.—Consists of the following five Associations: British Columbia Lumber and Shingle Manufacturers' Association; British Columbia Loggers' Association; Mountain Lumber Manufacturers' Association; Shingle Manufacturers' Association of British Columbia; Timberholders' Association of British Columbia.

Objects.—(1) To promote co-operation and stability in the forest industries of British Columbia and help the development of the timber resources of the Province; (2) to provide central facilities for the association of forest industries and timbermen; (3) to collect and circulate information useful to timber owners, lumbermen, loggers, and other members of the forest industries.

Officers.—President, J. D. McCormack; Managing Director, Wm. McNeill.

BRITISH COLUMBIA LUMBER AND SHINGLE MANUFACTURERS' ASSOCIATION

Head Office: Metropolitan Building, Vancouver, B.C. Organized, 1900. Number of members, 50.

Objects.—This body, which is incorporated under the Companies Act, with a capital of \$50,000, and whose affairs are administered by a Board of Directors, has, among other objects the establishment of uniform rules for grading and weighing lumber products and, as far as possible, standardizing their manufacture and such other measures as may be deemed for the general welfare of the members of the Association. The British Columbia Lumber Inspection Bureau is organized under this Association to ensure proper grading and certification of B.C. timber products, especially for the domestic and rail trade.

Officers.—President, Aird Flavell; Secretary, R. H. H. Alexander.

SHINGLE MANUFACTURERS' ASSOCIATION OF BRITISH COLUMBIA

Head Office: Metropolitan Bldg., Vancouver, B.C. Organized, 1910. Number of members, 70.

Object.—Development of the Red Cedar Shingle industry and markets, through the manufacture and sale of uniform high-grade products.

Officers.—President, C. E. Merritt; Sec.-Mgr., E. M. Dearing.

BRITISH COLUMBIA LOGGERS' ASSOCIATION

Head Office: Metropolitan Bldg., Vancouver, B.C. Organized, 1907. Number of members, 60.

Objects.—(1) To bring together persons interested in the logging business for the promotion of co-operation within the industry and for the collection and interchange of information and statistics regarding the production and consumption of logs; (2) to foster movements which would be beneficial to the general public interest and particularly to the logging industry; (3) to maintain stability by co-operative action in both production and values of the product dealt in by the members.

Officers.—President, T. A. Lamb; Sec.-Mgr., R. V. Stuart.

MOUNTAIN LUMBER MANUFACTURERS' ASSOCIATION

Head Office: Calgary, Alberta. Organized, 1900. Number of Members, 40.

Objects.—To provide a medium through which those engaged in the manufacture of lumber or kindred products may co-operate for mutual benefit and for the advancement of the industry as a whole.

Officers.—President, W. K. Nicholls; Sec.-Mgr., J. R. Poole.

TIMBERHOLDERS' ASSOCIATION OF BRITISH COLUMBIA

(Allied with the Timber Industries Council of British Columbia)

Head Office: Metropolitan Bldg., Vancouver, B.C. Organized, 1921. Number of Members, about 150.

Object.—To promote in every possible way the interests of owners of British Columbia timber.

Officers.—President, C. S. Battle; Secretary, Wm. McNeill.

NORTHERN BRITISH COLUMBIA TIMBERMEN'S ASSOCIATION

Head Office: Prince Rupert, B.C. Organized, 1921. Number of Members, 15.

Object.—To secure wider and more profitable markets for Northern British Columbia timber.

Officers.—President, G. W. Nickerson; Secretary, Arthur Brooksbank.

PACIFIC LUMBER INSPECTION BUREAU (INTERNATIONAL)

Head Office: Metropolitan Bldg., Vancouver, B.C. Organized, 1903. Number of Members, 270 (47 in Canada—all in British Columbia).

Object.—The survey and inspection of timber products. This Bureau inspects and issues certificates for most of the lumber exported by vessel from the Pacific Coast.

Officers.—President, C. W. Stinson; Vice-President, A. J. Hendry; Secretary, F. W. Alexander.

THE WHOLESALE LUMBER DEALERS' ASSOCIATION OF ONTARIO

Head Office: Toronto, Ontario. Number of Members, about 20.

Object.—To promote and safeguard the business interests of its members.

Officers.—President, J. L. MacFarlane; Secretary, J. L. Campbell.

ONTARIO RETAIL LUMBER DEALERS' ASSOCIATION

Head Office: Toronto, Ontario. Organized, 1918.

Object.—To co-operate in all matters affecting the retail lumber trade so as to protect and further its interests.

Officers.—President, F. V. VanDusen; Secretary, Horace Boulton.

THE WESTERN RETAIL LUMBERMEN'S ASSOCIATION

Head Office: Winnipeg, Manitoba.

Object.—To advance the interests of its members and give better service to the public through the advantages of co-operation.

Officers.—President, Roy G. Roberts; Sec.-Treas., F. W. Ritter.

THE BRITISH COLUMBIA WHOLESALE LUMBER AND SHINGLE ASSOCIATION

Head Office: Vancouver, B.C.

Object.—To promote the interests of the wholesale lumber and shingle trade on the Coast.

Officers.—President, W. Mark de Cew; Secretary, ———

NEW BRUNSWICK FOREST PRODUCTS ASSOCIATION

Head Office: Saint John, New Brunswick. Organized, April 25, 1928 (replacing the New Brunswick Lumbermen's Association). Number of Members, about 40.

Object.—The new name was adopted in order that the scope of the organization might include the activities of the pulp and paper interests. Briefly, the main objects are:—

1. To develop the forest resources of the province.
2. To promote a cordial spirit of co-operation among the associated wood-using industries.
3. To promote forest conservation and the prevention of waste.
4. To furnish a central agency to widen the markets and increase the stability and prosperity of the timber industries of the Province.

Officers.—President, C. W. Alden, Nashwaak Pulp and Paper Co., St. John, New Brunswick; Sec.-Treas., W. E. Anderson, St. John, New Brunswick.

THE CANADIAN PULPWOOD ASSOCIATION

Head Office: Halifax, Nova Scotia (P.O. Box 280). Organized, 1924. Number of Members, 91 active.

Objects.—Among the chief objects of the association are:—

1. To promote dominion-wide co-operation in all movements aiming at forest conservation, fire protection, and improved methods in forestry generally, and in the pulpwood business particularly.

2. To promote investigation and study of all matters of general interest to woodland owners, jobbers, and dealers; arbitration in case of disputes affecting members of the association; the making and enforcing of agreements for the benefit of its members; the collection, classification, and distribution to members of all statistics of any value relating to the pulpwood business.

Officers (1927).—President, Angus McLean, Bathurst, New Brunswick; Secretary, Miss D. P. Munroe, Halifax, Nova Scotia.

THE QUEBEC FOREST INDUSTRIES ASSOCIATION, LTD.

Head Office: Quebec, P.Q. (126 St. Peter Street). Organized, 1924. Number of Members, about 40.

Object.—To promote and facilitate the exchange of ideas in matters of forest protection, forest management, and forest utilization within the Province of Quebec; cordial and effective co-operation with the provincial government in every phase of forest conservation.

Officers.—President, John H. Price; Manager, J. A. Duchastel; Sec.-Treas., Angus Graham.

QUEBEC RETAIL LUMBER DEALERS' ASSOCIATION

Head Office: Montreal, Quebec. Organized, about 1918. Number of Members, 225.

Object.—Co-operative effort in the best interests of the trade.

Officers.—President, J. M. Dessureault; Secretary, J. L. Bourbouniere.

THE MONTREAL WHOLESALE LUMBER DEALERS' ASSOCIATION

Head Office: Montreal, Quebec. Organized, 1918. Number of Members, 24 (Companies or Dealers).

Object.—To promote and protect in every way the interests of the wholesale lumber trade.

Officers.—President, L. G. Gravel; Secretary, F. H. Devenish.

CANADIAN PAPER BOX MANUFACTURERS' ASSOCIATION INC.

Head Office: Toronto, Ontario. Organized, 1916. Number of Members, 90.

Objects.—(1) To uphold the standing of the paper-box business by educating the general public to a realization of the usefulness and increasing necessity of the paper box, and the extent and size of the paper-box industry; (2) to raise the general standard of efficiency of those in the business whereby the capital involved shall have a proper return thereon, the management shall be adequately rewarded, the wages paid and factory conditions shall be such as to attract a good class of labourers, and the quality of the product turned out be improved; (3) to exchange information as to costs and other matters of general interest relating to the paper-box business; (4) to maintain and continue, by social intercourse, the good feeling at present existing among the trade and those supplying it.

Officers.—President, B. Sproule; Secretary, S. J. France, 24 King Street East, Toronto 2, Ontario.

FOREST PROTECTIVE ASSOCIATIONS IN QUEBEC

THE SOUTHERN ST. LAWRENCE FOREST PROTECTIVE ASSOCIATION

Head Office: Quebec, P.Q. Organized, 1917. Number of Members, 44.

Object.—Forest fire protection on the limits of the members. Area patrolled, 3,787 square miles.

Officers.—President, David Champoux; Sec.-Mgr., Western Division, C. B. Guerin, Quebec, P.Q.; Sec.-Mgr., Eastern Division, J. D. Brule, Val Brilliant, P.Q.

THE LAURENTIAN FOREST PROTECTIVE ASSOCIATION

Head Office: Quebec, P.Q. Organized, 1917. Number of Members, 31.

Object.—Forest fire protection on the limits of the members. Area patrolled, 13,222 square miles.

Officers.—President, H. Sorgius; Secretary-Manager, P. W. MacKay.

THE OTTAWA RIVER FOREST PROTECTIVE ASSOCIATION

Head Office: Ottawa, Ontario (16 Fraser Bldg.). Organized, 1914. Number of Members, 47.

Object.—Forest fire protection on the limits of the members. Area patrolled, 14,972 square miles.

Officers.—President, Fred. E. Bronson; Gen.-Mgr., Arthur Graham.

THE ST. MAURICE FOREST PROTECTIVE ASSOCIATION

Head Office: Three Rivers, Quebec. Organized, 1912. Number of Members, 13.

Object.—Forest fire protection on the limits of the members. Area patrolled, 14,000 square miles.

Officers.—President, Ellwood Wilson; Manager, L. Judson.

THE LOWER OTTAWA FOREST PROTECTIVE ASSOCIATION

Head Office: Hull, Que. (c/o E. B. Eddy Co.). Organized, 1927. Number of Members, 4 Companies.

Object.—Forest fire protection on the limits of the members. Area patrolled, 12,890 square miles.

Officers.—President, T. F. Kenny; Manager, N. M. Ferguson.

THE PRICE BROTHERS FOREST PROTECTIVE ASSOCIATION

Head Office: Quebec, P. Q. Organized, 1924.

Object.—Forest fire protection on the limits of the Company. Area patrolled, 10,395 square miles.

Officers.—President, John H. Price; managers, R. D. Jago, J. G. Ross, W. G. Wright.

10—Education and Research

FACULTY OF FORESTRY, UNIVERSITY OF TORONTO

One of the first public manifestations of interest in the care and protection of forests on this continent expressed itself in the American Forestry Congress held at Cincinnati, Ohio, in April, 1882. The province of Ontario sent several delegates to this meeting. Another session of the Forestry Congress was held in Montreal in August of the same year. The stimulus of the public discussion following the Forestry Congress undoubtedly led to the establishment of the position of Clerk of Forestry by the provincial Government in 1883. The first two incumbents of this office were very active in forestry propaganda, writing extensively for magazines and newspapers and issuing lengthy annual reports, in which they stressed the desirability of establishing a school for the training of foresters. The agitation thus initiated finally bore fruit in the recommendation for the establishment of such a school in the report of the Royal Commission on University of Toronto affairs in 1906, and this recommendation in turn resulted in the establishment of the Faculty of Forestry at the University of Toronto in 1907. The late Dr. Bernhard E. Fernow, who had served for more than twenty years as Chief Forester of the United States and who had established the first forest school in America at Cornell University, was invited to come to Canada as Dean of the Faculty, and for 12 years his aggressive but kindly influence was the chief fashioner of forestry in Canada. Upon his retirement Dr. C. D. Howe was appointed Dean. In addition there are three Professors of Forestry and one Lecturer on the Faculty.

The Faculty of Forestry of the University of Toronto offers a four-year undergraduate course, leading to the degree of Bachelor of the Science of Forestry. The first two years are devoted mainly to subjects in the fundamental sciences, such as botany, chemistry, geology, mineralogy, physics, surveying, and the modern languages. The last two years are given over almost entirely to forestry subjects. The students are expected to engage in actual field-work during their summer vacations. In the academic year one-half of the student's time is taken up with field or laboratory work or in practice camp.

Since the establishment of the Faculty in 1907, 120 men have graduated. Of these 47 are employed by pulp and paper companies or by other forest industries, 33 are in the Provincial Forestry Branch of Ontario, 22 in the Dominion Forest Service, 6 are engaged in teaching, and 12 are in private business.

THE FOREST SCHOOL OF THE UNIVERSITY OF NEW BRUNSWICK

The Forest School was added to the provincial University at Fredericton in 1908, and since that time has occupied a prominent place in forestry education in Canada.

The course consists of four years leading to the degree of Bachelor in the Science of Forestry, and a Master's degree may be secured three years subsequent to graduation upon furnishing satisfactory evidence of employment for at least three years in actual forestry work and presenting a satisfactory thesis on some subject approved by the faculty.

The first two years are devoted mainly to the basic sciences, modern languages, etc., with some special botany and field-work in forestry. In the two final years the usual forestry subjects are taught in addition to surveying, forest engineering, hydraulics, and lumbering. A tract of 3,640 acres of forest, three miles from the University, which has been turned over to the care of the Forest School, provides excellent facilities for practice and demonstration.

Over seventy men have graduated from this School and have found employment with the various Canadian forest services, pulp and paper companies, and in private practice.

Horace P. Webb, M.Sc.F., is Professor of Forestry and has one assistant.

SCHOOL OF SURVEYING AND FORESTRY, QUEBEC

A School of Forestry was founded by the government of the province of Quebec in 1910, primarily for the training of men for its own forest service. It has since been amalgamated with the School of Surveying, and is now known as L'Ecole d'Arpentage et de Génie Forestier, and is affiliated with Laval University at Quebec. The course covers four years, leading to diplomas in both sciences. The degree of Surveyor is granted at the end of the third year, and that of Forest Engineer at the end of the fourth year. The instruction is given chiefly in the French language, although applicants for admission must be able to read and write English correctly.

The fundamental studies include elementary and advanced mathematics, chemistry, physics, and mechanics. Special courses are provided in astronomy, meteorology, natural history, soils, surveying, medicine, public works construction, mineralogy, geology, law, botany, and hydraulics. The forestry subjects include theory of forestry, planting, dendrology, utilization, silviculture, dendrometry, forest industries, wood-using industries, forest protection, forest technology, forest management, history of forestry, and forest economy and geography. In addition to lectures, experimental and practical work in field and laboratory is given in connection with most of the subjects.

Technical and practical work is provided every year in a forest located about 20 miles from Quebec, the property of Laval University, or in a township forest reserve, situated on the southern shore of the St. Lawrence. Instruction in nursery practice and planting is also given at the Berthierville nurseries. During the summer vacation, the students acquire experience in the forests on government or private work. So far, the school has granted the degree of Forest Engineer to eighty men.

The Chief of the Forest Service, Quebec, is ex-officio Inspector-General of instruction in forestry and the provincial government grants \$15,000 annually to Laval University to aid in maintaining the school.

Avila Bedard, M.F., is Director of the School.

PAPERMAKING SCHOOL, QUEBEC

For the last five years the Papermaking School has been in operation at Three Rivers, Quebec, in conjunction with the Three Rivers Technical School. An advisory board selected by the Canadian Pulp and Paper Association co-operates in the direction of the school, and the provincial government makes an annual grant towards its support. The Chief of the Forest Service is inspector general, as in the case of the other schools.

In addition to the regular course, night courses are given.

Mr. Victor Baillargé is the director.

FOREST RANGER SCHOOL

Recognizing the necessity of training men for subordinate positions in forestry, the Quebec Government, in 1922, established a school for rangers. The school is located at Berthierville in connection with the nurseries. The course covers eight months divided into four terms of two months each, extended over a period of two years. Field practice under remunerative employment intervenes between the terms. This arrangement permits the students to be self-supporting throughout their course.

The object of the instruction is to fit men to act as forest rangers, fire rangers, fish and game wardens, cullers, foremen of forest operations, etc. A good common-school education is required for admission.

Elementary instruction is given in a number of subjects relating to forest protection and administration, but particular attention is paid to forest mensuration, surveying, and silviculture. The annual entry is limited to thirty students, and there are more applicants than can be accommodated. The school is supported by the provincial Government under the Chief of the Forest Service, with Henri Roy, F.E., as Director.

UNIVERSITY OF BRITISH COLUMBIA

The University of British Columbia at Vancouver since 1921 has had a department of forestry, in which a four-year course is given leading to the degree of Bachelor of Science in Forestry.

The first two years of the course are largely engineering and fundamental sciences. The final two years are devoted primarily to forestry.

A special course, designed to give a thorough training in all branches of engineering that apply to the lumber industry, is provided for those who wish to enter the lumber industry equipped as logging engineers. For this purpose, the location of the school at Vancouver offers exceptional advantages, as pulp-mills, extensive forests and lumber operations, large sawmills, and wood-using and wood-preserving plants are all within easy reach. As an essential supplement to the class-room work, the student must obtain experience in actual practice during the summer vacations.

The Department of Forestry at Vancouver has the advantage of having the Dominion Forest Products Laboratory located at the University, and a co-operative arrangement prevails whereby the students have access to the laboratory to watch the investigations in progress and to use the equipment in studying properties of Canadian woods.

Professor H. R. Christie, B.Sc.F., is head of the department and has one Assistant Forester.

RESEARCH AND EXPERIMENTAL WORK

DOMINION

Silvicultural Research

Silvicultural research was started in Canada in 1912 by the Commission of Conservation and was continued by it until the Commission was abolished in 1921. The work undertaken was chiefly a study of reproduction on cut-over and burned-over lands.

Though various investigations had been conducted previously on the National Forests, it was not until the establishment of the Petawawa Forest Experiment Station in 1918 that the

Forest Service inaugurated a systematic plan of research in the fundamental principles of silviculture. When the Commission of Conservation was abolished, the Forest Service took over the Research Staff of the Commission and continued the projects under way. The Petawawa Experiment Station, which is situated in the Ottawa Valley in Ontario, is part of the Petawawa Military Reservation and covers 100 square miles. The original forest, in which white and red pine predominated, has been cut during the last 75 years, and the remaining stand is typical of the cut-over areas in the mixed softwood-hardwood type, with reproduction of most of the eastern species in various stages of development.

Another permanent experiment station is established near Grand-Mère, Quebec, in co-operation with the Laurentide Company, Limited. This is also in the mixed type, but with spruce and balsam fir predominating. In addition to these stations, investigations are conducted in practically every province in co-operation with the provincial forest authorities or timber-owning corporations, and numerous temporary and permanent sample plots are established.

The Research Division of the Forest Service now consists of six technically trained foresters and the necessary clerical staff. On the National Forests, research is carried on by the District Inspectorates under the direction of the Research Division.

Mensuration.—One of the first problems to be solved was that of actually measuring the standing timber. After extensive tests it was found that Tor Jonson's form-class method was applicable to Canadian species, and volume tables have been prepared by this method for the principal coniferous species.

The use of various commercial units of measurement, including five board-foot log scales, as well as cords, necessitated the determination of factors to convert these to common cubic measure.

The application of statistical methods to the compilation of forest data has been highly developed in the Forest Service.

Regeneration and Rate-of-Growth Surveys.—Practically no information exists as to the nature, extent, and rate of growth of the natural regeneration which is being secured after cutting or fire, and in order to obtain some concrete data over comparatively extensive areas, a number of surveys, covering 225 square miles, have been conducted on cut-over and burned-over lands in eastern Canada. The present stand is determined by means of a line-plot survey, and an estimate is made of the mortality during the last decade. The rate of growth is obtained from increment borings. Since the line-plots are permanently marked, it is possible to resurvey the areas five or ten years hence. Large permanent sample plots representing typical conditions are established on each area surveyed, and on these more detailed study of the increment and mortality is conducted.

Artificial Reforestation.—Investigations as to seed production of various species throughout the Dominion are conducted so that the periodicity of seed-years may be determined. The adaptability of seed from different localities for use in other districts is being studied, and it is found that there are marked differences in the same species collected from different sources.

Experiments in direct seeding have been made on 1,000 acres in New Brunswick, and 50 acres in Manitoba, Saskatchewan, and Alberta. This method of reforestation is very much cheaper than planting, costing only \$3 to \$5 per acre as compared with a planting cost of \$10 to \$20 per acre. The results have been very encouraging in New Brunswick, but it has not been so successful in Manitoba or Saskatchewan.

Experimental plantations are being established on many of the national forests in the west and at the Petawawa forest experiment station. The plantations of the Laurentide Company at Grand-Mère, Quebec, are also under observation. The objects of these experiments are to determine the species, age of stock, and density to use under the various conditions.

Types and Sites.—The conditions affecting the association of species in types and the reaction of these species on each other are important factors in determining the most desirable composition of the forests under management.

The classification of site conditions is very difficult in Canada owing to the extremely varied conditions and to the changes caused by fire and selective cutting. Cajander's system is being investigated and may help to solve this problem.

Type Conversion.—The release of the more valuable conifers from suppression by the undesirable poplar-whitebirch and the mature yellowbirch-maple types by cutting or girdling is under investigation, and so far it seems probable that, where the overstory is composed of large trees, girdling will produce the more satisfactory results, since the release is gradual. An overstory of 70-year-old jack pine has been removed to release a thrifty understory of red and white pine on several square miles at Petawawa.

Systems of Cutting to Induce Natural Regeneration.—Experimental cutting areas of several hundred acres in extent have been established in both eastern and western Canada. In each case two or more methods have been applied. Periodic examinations of the areas make the comparison of the methods possible.

Thinnings.—Numerous experiments in thinning have been conducted during the last ten years, and results are beginning to be apparent. Several methods, such as thinning from above and from below, have been tried, and it would seem that thinning by judgment, or "experience thinning," is after all the most practical method in the present stage of silviculture in Canada. The lack of a market for small material in most forest regions in Canada renders silvicultural operations of the kind expensive, though the increased increment and improvement in the stand would doubtless more than pay for the operation.

Tolerance.—Numerous permanent plots have been established in Ontario and Quebec to study the density requirements of white pine and white spruce.

Root Competition.—A series of plots in which the competitive roots of surrounding trees have been cut off by trenching around the plots was established at Petawawa last year to commence an investigation of root competition in relation to reproduction.

The Forest Products Laboratories of Canada

The first step in forest-products research work in Canada was taken in 1913 by the Dominion Government in the establishment of forest products laboratories at Montreal under the Dominion Forest Service. In 1918 an urgent need arose for tests on British Columbia timbers on account of their special value in aeroplane construction. A branch laboratory was, therefore, started at Vancouver in association with the British Ministry of Munitions and the University of British Columbia, and after the war it was continued for commercial investigations.

The Montreal laboratory was handicapped for several years on account of limited quarters, and in 1927 it was decided to move the main laboratories to Ottawa, where more adequate accommodation was available. The pulp and paper division of the laboratory was, however, left in Montreal at the special request of the Pulp and Paper Association of Canada, which offered to provide accommodation in the new Cellulose Institute which the Pulp and Paper Association of Canada, out of its own funds, has erected in Montreal. The establishing and equipping of the main laboratory in Ottawa and the pulp and paper division in Montreal are now practically complete.

Canada is, therefore, in an excellent position with the three organizations to carry on a comprehensive program of forest-products research. The Vancouver laboratory is equipped and staffed to look after the special problems of British Columbia, which cannot be adequately dealt with by the central laboratory on account of distance. The Pulp and Paper Division is located in the recognized centre of the pulp and paper activities of Canada, and can, therefore, work in close contact with these industries. The central laboratory in Ottawa is now in a position to function in close co-operation with the head office of the Forest Service.

BRITISH COLUMBIA

Studies of the distance seed is distributed from seed-trees, natural reproduction following fire and cutting, methods of slash disposal, and the preparation of volume and yield tables for Pacific species are the principal lines of research undertaken in British Columbia.

A forest-research station covering 6,400 acres was established in 1924 at Aleza Lake in the central interior portion of the province, and in 1927 a nursery was started at Victoria for experimental plantations.

ONTARIO

At the Forest Nursery Station at St. Williams, the Forestry Branch is conducting a number of interesting experiments in natural and artificial regeneration. The fixation of shifting sand by various methods has been tried at several places. Intensive studies of reproduction and rate of growth, especially of white pine, have been conducted for several years for the purpose of developing yield tables. A successful series of experiments in the flotation of hardwood have been carried on.

QUEBEC

Experiments in artificial regeneration are in progress at the Berthierville nursery station and elsewhere throughout the Province.

MARITIME PROVINCES

In New Brunswick and Nova Scotia silvicultural research is being carried on in co-operation with the Dominion Forest Service.

11—Annual Increment and Utilization

There is as yet insufficient data upon which to venture an estimate of the increment which is being secured in Canada. During recent years many local studies have been made throughout the Dominion with such widely divergent results that they cannot be applied to the large areas involved.

Of the accessible area, it is estimated that there are 200,000 square miles of mature timber in which decay offsets growth and 665,880 square miles on which the forests are in a growing condition. On the whole, natural regeneration is good, except where repeated fires have reduced the recuperative powers of the forests and destroyed the fertility of the soil, but over large areas fires and exclusive cutting of conifers have so altered the composition of the forests that the land is understocked as far as the more valuable species are concerned. Large areas are overstocked and only a fraction of the possible increment is being secured due to lack of thinning.

Extreme variations in climatic and soil conditions, especially of the drainage, render any broad estimate most difficult, if not impossible.

Investigations have shown that in well stocked young stands in British Columbia and in the St. Lawrence drainage area in Ontario and Quebec, an annual increment of 25 to 50 cubic feet per acre is frequently attained and in some instances over 100 cubic feet.

The British Columbia Forest Branch considers an average rate of 12 cubic feet per acre applicable on 120,692 square miles of immature forest. The New Brunswick Forest Service

claim 13 cubic feet on all forest lands except those on settlers' lands, although this seems very high as compared to British Columbia where more study has been given to the question of increment.

A gross annual increment of 10 cubic feet per acre on 665,880 square miles would amount to 4,260 million cubic feet, which considerably exceeds the present annual cut of 2,708 million cubic feet.

During the five years, 1922-1926, the area of young growth and cut-over land burned annually averaged 1,392,000 acres. The young growth on this area probably represented the accumulation of thirty years' increment, which, if it grew at the rate of 10 cubic feet per acre, would, at least potentially, amount to 417,600,000 cubic feet. Insects, decay, and breakage due to snow and wind are thought to be probably as great as the loss from fire, which would bring the total depletion in young stands to 835,200,000 cubic feet.

During 1922-1926, the average annual cut of merchantable timber was 2,708 million cubic feet, and the loss from fire is estimated to have been 900 million cubic feet. Assuming that the loss through insects and decay is approximately the same, the total annual depletion in merchantable stands would be 4,400 million cubic feet.

In view of the absolute uncertainty of the rate of increment, it is not considered advisable to fill in Table III.

TABLE IVA.—ANNUAL UTILIZATION OF HOME-GROWN TIMBER AND MINOR PRODUCTS
Average 1922-1926

Type of Product	Unit of measurement	Conifers			Broad-leaved			Total		
		Commercial units	Equivalent in standing timber	Value	Commercial units	Equivalent in standing timber	Value	Commercial units	Equivalent in standing timber	Value
			1,000 cu. ft.	\$		1,000 cu. ft.	\$		1,000 cu. ft.	\$
Lumber.....	M ft. b.m.	3,574,613	782,840	93,300,787	189,396	41,478	6,316,436	3,764,009	824,318	99,617,223
Lath.....	M pcs.	1,204,261	21,861	6,186,663				1,204,461	21,861	6,186,663
Shingles.....	"	2,962,153	65,167	10,419,397				2,962,153	65,167	10,419,397
Paper produced.....	tons	1,765,141	407,125	133,304,240				1,765,141	407,125	133,304,240
Pulp exported.....	"	888,549		45,663,469				888,549		45,663,469
Pulpwood exported.....	cords	1,117,868	130,791	11,220,090	190,342	22,270	1,911,267	1,328,210	153,061	13,131,357
Logs and timber exported.....	M ft. b.m.	366,680	80,303	6,934,799	14,984	3,281	453,620	381,664	83,584	7,388,419
Railway ties.....	No.	13,196,794	158,362	10,618,425	1,185,000	14,220	1,777,500	14,381,794	172,582	12,395,925
Poles.....	"	729,948	9,490	3,103,801	20,848	271	87,774	750,796	9,761	3,191,575
Posts.....	"	13,267,621	26,535	1,322,122	639,738	1,279	63,750	13,907,359	27,814	1,385,872
Fence-rails.....	"	5,033,640	10,068	428,774	210,753	421	19,567	5,244,393	10,489	448,341
Round and mining timber.....	M ft. b.m.	55,628	18,256	1,489,872				55,628	18,256	1,489,872
Fuel-wood.....	cords	1,270,978	120,741	6,483,442	7,807,453	741,710	33,683,999	9,078,432	862,451	39,167,441
Wood for distillation.....	"				54,076	6,651	501,760	54,076	6,651	501,760
Miscellaneous.....		242,040	28,319	2,395,283	142,150	16,631	1,406,753	384,190	44,950	3,802,036
Total.....			1,859,858	331,871,164		848,212	46,222,426		2,708,070	378,093,590

The division of the amount of timber consumed into softwood and hardwood is largely an estimate. Accurate statistics regarding the species used are collected only for lumber, lath, and shingles and for pulpwood used in Canada, which comprise less than one-half of the total cut. Of the hardwood, it is estimated that 87.4 per cent is used for fuel, 4.9 per cent as lumber, 2.6 per cent is poplar pulpwood exported, and 1.7 per cent railway ties. The development of preservative treatment for ties is very materially increasing the use of hardwoods for this purpose.

The term "hardwood" is applied to all broad-leaved deciduous trees, though some of them, such as poplar, cottonwood, and basswood, are softer than many of the coniferous species which are classed as "softwood."

TABLE IVB—AVERAGE ANNUAL CONSUMPTION OF HOME-GROWN TIMBER BY PROVINCES, 1922-1926, IN 1,000 CUBIC FEET OF STANDING TIMBER

Provinces	Softwood	Hardwood	Total
Prince Edward Island.....	5,340	10,080	15,420
Nova Scotia.....	69,000	45,000	114,000
New Brunswick.....	177,000	42,840	219,840
Quebec.....	490,000	351,450	841,450
Ontario.....	432,000	322,400	754,400
Manitoba.....	29,000	30,765	49,765
Saskatchewan.....	28,000	22,920	50,920
Alberta.....	38,100	22,515	60,615
British Columbia.....	591,418	242	591,660
Canada.....	1,859,858	848,212	2,708,070

TABLE IVC—AVERAGE ANNUAL PRODUCTION, IMPORTS, EXPORTS AND HOME CONSUMPTION,
1922-1926
Quantities Reduced to, and Stated in, Equivalents in Standing Timber

	Total production	Imports	Exports	Home consumption
	1,000 cu. ft.	1,000 cu. ft.	1,000 cu. ft.	1,000 cu. ft.
Logs and Bolts—				
Lumber, lath, shingles, logs and square timber.....	994,929	35,396	639,662	390,663
Pulpwood—				
Paper, pulp and pulpwood.....	560,186	23,872	523,799	60,259
Fuel-wood.....	862,451	682	1,513	861,620
Railway ties.....	172,582	7,174	15,402	164,354
Posts and rails.....	38,304	252	1,774	36,782
Mining timber.....	18,256			18,256
Poles.....	9,760	120	7,513	2,367
Distillation wood.....	6,651			6,651
Manufactured wood—				
Furniture, caskets, doors, sash, etc.....		5,009	1,586	3,423
Miscellaneous.....	44,950	3,137	15,199	32,888
Total.....	2,708,069	75,642	1,206,448	1,577,263

12.—Forest Industries

The forest industries are second only to agriculture in value of production and exports. Exclusive of printing establishments, there were, in 1926, 5,901 manufacturing plants in which wood or paper was the principal basic material used. These plants employed 104,697 persons, and distributed about \$119,334,839 in salaries and wages. The printing plants numbered 1,660, and employed 29,490 people, to whom \$41,581,890 was paid.

The pulp and paper industry has become the most important manufacturing industry in the Dominion, as measured by gross and net value of products and salaries and wages distributed. The lumber industry, which includes the manufacture of shingles and lath, though fourth in gross value of products, ranks second in net value of products and in wages and salaries paid. The secondary forest industries, such as planing mills, sash and door, box, and furniture factories, establishments for the building of boats and canoes, etc., in which wood is the primary raw material used, are also prominent among manufacturing industries. Other industries, such as the making of agricultural implements and automobiles, and ship-building, use large quantities of wood but are not counted in this category.

The woods operations, which provide employment to 81,000 men and distribute \$72,000,000 in salaries and wages, besides supplying the manufacturing plants with wood, turn out large quantities of products such as pulpwood and logs for export, poles, posts, railway ties, etc., which are finished ready for use. Fuel-wood, which is the largest item in domestic consumption, is for the most part extracted by farmers from their own woodlots.

Complete statistics as to the amount of timber consumed are secured only for the decennial census; but the Bureau of Statistics now collects annual reports from the more important industries, and fairly accurate estimates can be made of the other products.

In 1926, the capital invested in the pulp and paper industry was \$501,184,714; in the lumber industry, \$175,186,704; in the planing mills and sash and door factories, \$49,413,163, and in woods operations \$150,000,000. The other industries depending primarily on the forests would bring the total capital invested to about \$900,000,000.

In few industries does manufacture add a higher percentage to the value of the raw material used than in the wood-using industries. In the pulp and paper industry the value of the raw materials is increased by 252 per cent, and in the lumber industry by 171 per cent. By manufacture of lumber into planing-mill products, sash, doors, etc., the value is increased a further 191 per cent.

The total sale value of the forest products averaged over \$450,000,000 annually during 1922-1926, and is expected to be not less than \$475,000,000 in 1927.

MINOR FOREST PRODUCTS

Under this heading may be considered maple sugar and syrup, balsam gum, resin, cascara, moss, tan bark, and furs. It is difficult to secure accurate information as to the production or trade in most of these products. Maple sugar and syrup is produced chiefly from farmers' woodlots, and is valued at about \$5,275,000 annually. Of this about \$1,000,000 worth is exported. The value of balsam gum exported is approximately \$20,000.

The value of raw furs averages \$15,000,000, of which about \$750,000 comes from fur farms and the balance is trapped in the forests. The total value of raw furs exported is shown as \$21,000,000, which indicates an appreciation of value due to passing through the hands of several dealers before exportation. Ninety-five per cent of this is wild fur.

The game and fish and the recreational features of the forests attract thousands of tourists to the country. The value of the tourist trade is estimated to be not less than \$200,000,000 annually, and is increasing rapidly. At least 50 per cent of this may be claimed for the forests.

TRANSPORTATION

Two transcontinental railway systems with numerous branches, amounting in all to over 41,000 miles of tracks, provide excellent facilities for transporting forest products to the manufacturing centers and to export ports. Since all the railways in Canada are constructed on the

same standard and this standard is the same as that in the United States, there is no hindrance to the interchange of equipment, and shipments can be made from any station in Canada to any other place in Canada or to any place in the United States without change of cars. The railway termini on the Pacific coast are Vancouver and Prince Rupert, but the extensive system of deep waterways protected by the outlying islands makes it possible to ship by sea-going vessels from almost any place along the coast throughout the year, and logs can be towed for hundreds of miles to the manufacturing plants. The Great Lakes and the St. Lawrence river provide water transportation from Port Arthur to Montreal. Though grain is the principal commodity handled on this route, a considerable quantity of wood and wood products is carried. The principal ports for Atlantic shipment are Montreal, Quebec, St. John, and Halifax. The latter two are open in winter as well as in summer.

TABLE V—QUANTITY AND VALUE OF TIMBER USED BY PRIMARY FOREST INDUSTRIES
Annual Average for the Period 1922 to 1926

	Quantity of timber consumed (Home-grown and imported)		Value of product	No. of persons employed
	Commercial Unit	Equivalent in standing timber		
		1,000 cu. ft.	\$	
<i>Lumber Industry—</i>				
Lumber, M ft. board measure.....	3,764,009	824,317	99,617,223	
Lath, M pcs.....	1,204,461	(a) 21,861	6,186,683	
Shingles, M pcs.....	2,962,153	65,167	10,419,397	
Logs and timber imported, M ft. board measure.....	9,897	2,167		
Total.....		913,512	116,223,303	84,600
<i>Pulp and Paper Industry—</i>				
Paper mfg. tons.....	1,765,141	246,012	133,304,240	
Pulp exported, tons.....	688,549	161,113	45,663,469	
Pulp imported, tons.....	21,355	4,693		28,400
Total.....		411,818	178,967,709	
<i>Woods operations—</i>				
Logs and timber exported, M ft. board measure.....	381,664	83,584	7,333,814	
Pulpwood exported, cords.....	1,308,210	153,061	13,131,358	
Poles, Pcs.....	750,796	9,760	3,191,575	
Mining timber, Lineal feet.....	55,664	18,256	1,489,872	
Posts, Pcs.....	13,907,359	27,815	1,385,872	
Fence-rails, Pcs.....	5,244,393	10,489	448,341	
Railway ties, Pcs.....	14,381,794	172,582	12,395,925	
Fuel-wood, cords.....	9,078,432	862,451	39,167,441	
Distillation wood, Cords.....	54,076	6,651	501,760	
Miscellaneous, Cords.....	384,190	44,950	3,802,036	(b) 81,000
Total.....		1,389,599	82,847,994	
<i>Manufactured wood—</i>				
Furniture, caskets, doors, paper goods, etc.....			(c) 75,000,000	(d) 34,340
Grand total.....		2,714,929	453,039,006	178,340

NOTES.—

This table does not include 68,782,000 cubic feet, valued at \$28,130,159, which was imported in a manufactured state ready for use, e.g., lumber, paper, ties, fuel-wood, etc.

(a) One-half of the lath is considered as by-product of lumber manufactured, and therefore is not included here.

(b) Includes employees in woods operations for lumber and pulp and paper industries. The number of employees is figured on the man-year basis, and, owing to the seasonal employment both in woods and mills, it is thought that at least twice as many individuals secure a substantial portion of their employment in connection with the forest industries.

(c) Estimated value added by further manufacture.

(d) Employees in industries in which wood is the principal raw material used.

TABLE VA—LUMBER PRODUCED IN CANADA, 1908 TO 1926

Year	Quantity of lumber produced	Volume used	Equivalent standing timber	Value of lumber produced	Average value per M ft. B.M.
	M ft. B.M.	M cu. ft.	M cu. ft.	\$	\$
1908.....	3,347,126	278,927	733,021	54,338,036	16.27
1909.....	3,814,942	317,912	835,472	62,819,477	16.41
1910.....	4,451,652	370,971	974,914	70,609,233	15.81
1911.....	4,918,202	409,850	1,077,086	75,630,954	15.42
1912.....	4,389,723	365,810	961,349	69,475,784	15.83
1913.....	3,816,642	318,054	835,845	65,796,438	17.24
1914.....	3,946,254	328,854	864,230	60,363,369	15.30
1915.....	3,842,676	320,223	841,546	61,919,806	16.11
1916.....	3,490,550	290,879	764,430	58,365,349	16.72
1917.....	4,151,703	345,975	909,224	83,655,097	20.15
1918.....	3,886,631	323,886	851,172	103,700,620	26.28
1919.....	3,819,750	318,312	836,525	122,030,653	31.95
1920.....	4,302,625	358,552	942,275	168,368,437	39.13
1921.....	2,869,307	239,109	628,378	82,448,585	28.73
1922.....	3,138,598	261,550	687,353	84,554,172	26.94
1923.....	3,728,445	310,704	816,529	108,290,542	29.04
1924.....	3,878,942	323,245	849,498	104,444,622	26.93
1925.....	3,888,920	324,077	851,673	99,725,519	25.64
1926.....	4,185,140	348,762	916,546	101,071,260	24.15
<i>Average</i>					
1922-26.....	3,764,009	313,667	824,320	99,617,223	26.52

TABLE VB—LATH PRODUCED IN CANADA, 1908 TO 1926

Year	Quantity produced	Volume used	Value of lath produced	Average value per M pcs.
	M pcs.	M cu. ft.	\$	\$
1908.....	672,362	9,299	1,489,525	2.21
1909.....	732,136	10,125	1,709,865	2.33
1910.....	852,453	11,789	1,943,544	2.28
1911.....	965,235	13,350	2,212,226	2.29
1912.....	897,004	12,405	2,064,622	2.30
1913.....	751,052	10,387	1,787,325	2.37
1914.....	625,010	8,644	1,585,484	2.54
1915.....	973,226	10,970	2,040,819	2.57
1916.....	665,498	9,203	1,743,940	2.62
1917.....	616,949	8,532	1,828,018	2.96
1918.....	438,100	6,059	1,369,616	3.13
1919.....	520,203	7,194	2,157,758	4.15
1920.....	750,031	10,511	5,248,879	6.90
1921.....	804,449	11,127	4,188,121	5.21
1922.....	1,031,420	14,265	5,690,326	5.52
1923.....	1,153,735	15,956	6,324,747	5.48
1924.....	1,165,819	16,123	5,975,253	5.10
1925.....	1,292,963	17,881	6,415,927	4.96
1926.....	1,378,366	19,063	6,527,060	4.73
Average				
1922-26.....	1,204,461	16,658	6,186,662	5.14

TABLE VC—SHINGLE PRODUCTION IN CANADA, 1908 TO 1926

Year	Quantity Shingles produced	Volume used	Equivalent in standing timber	Value of shingles produced	Average value per M pcs.
	M pcs.	M cu. ft.	M cu. ft.	\$	\$
1908.....	1,506,396	12,503	33,141	3,109,046	2.06
1909.....	1,708,908	14,184	37,596	3,408,702	1.99
1910.....	1,976,640	16,406	43,486	3,557,211	1.80
1911.....	1,838,474	15,259	40,446	3,512,078	1.91
1912.....	1,578,343	13,100	34,724	3,175,319	2.01
1913.....	1,485,279	12,328	32,676	3,064,641	2.06
1914.....	1,843,554	15,301	40,558	3,688,746	2.00
1915.....	3,089,470	25,643	67,968	5,734,852	1.86
1916.....	2,877,562	24,050	63,746	5,962,933	2.06
1917.....	3,020,956	25,074	66,461	8,431,215	2.79
1918.....	2,662,521	22,099	58,875	8,184,448	3.07
1919.....	2,915,309	21,197	64,137	13,525,625	4.63
1920.....	2,855,706	23,702	62,826	14,695,159	5.15
1921.....	2,986,530	24,789	65,705	10,729,096	3.59
1922.....	2,506,956	20,891	55,153	10,397,080	4.15
1923.....	2,718,650	22,655	59,810	9,617,114	3.54
1924.....	3,129,501	26,079	68,849	10,406,293	3.32
1925.....	3,156,261	26,302	69,437	11,154,773	3.53
1926.....	3,299,397	27,494	72,586	10,521,723	3.19
Average					
1922-26.....	2,962,153	24,684	65,167	10,419,396	3.52

TABLE VD—PULPWOOD PRODUCTION IN CANADA, 1908 TO 1926

Year	For home consumption	For export	Total	Volume used	Equivalent in standing timber	Total value	Average value per cord
	Cords	Cords	Cords	M cu. feet	M cu. feet	\$	\$ cts.
1908.....	482,777	842,308	1,325,085	119,258	155,035	7,732,055	5 84
1909.....	622,129	935,622	1,557,753	140,198	182,256	9,316,610	5 98
1910.....	598,487	943,141	1,541,628	138,747	180,370	9,795,196	6 35
1911.....	672,288	847,939	1,520,227	136,820	170,867	9,678,616	6 37
1912.....	866,042	980,868	1,846,910	166,222	214,248	11,911,415	6 02
1913.....	1,109,034	1,035,508	2,144,064	192,966	250,855	14,313,939	6 68
1914.....	1,224,376	972,508	2,196,884	197,720	255,036	14,770,358	6 72
1915.....	1,405,836	949,714	2,355,550	212,000	275,599	15,590,330	6 62
1916.....	1,764,912	1,068,207	2,833,119	254,981	331,490	19,971,127	7 05
1917.....	2,104,334	1,017,854	3,122,188	280,997	365,296	26,739,905	8 56
1918.....	2,210,744	1,349,536	3,560,280	320,425	416,553	37,886,259	10 64
1919.....	2,428,706	1,070,275	3,498,981	314,908	409,381	41,941,267	11 99
1920.....	2,777,422	1,124,404	4,024,826	362,234	471,905	61,183,060	15 21
1921.....	2,180,578	1,092,553	3,273,131	294,582	382,957	52,900,872	16 16
1922.....	2,912,608	1,011,332	3,923,940	353,154	459,101	50,735,361	12 93
1923.....	3,270,433	1,384,230	4,654,663	418,919	544,596	57,119,596	12 29
1924.....	3,316,951	1,330,250	4,647,201	418,248	543,723	57,777,640	12 43
1925.....	3,668,959	1,423,502	5,092,461	458,321	595,818	62,181,537	12 21
1926.....	4,229,567	1,391,738	5,621,305	505,917	657,693	68,100,303	12 12
Average, 1922-26.....	3,479,704	1,308,210	4,787,914	430,912	560,186	59,182,887	12 36

TABLE VE—AVERAGE PRODUCTION OF LUMBER, LATH, SHINGLES, AND PULPWOOD BY PROVINCES

For Five Years 1922 to 1926

Province	Lumber				Lath		Shingles				Pulpwood				Total	
	Used volume		Equiv- alent in standing timber	Value	Used Volume		Value	Used volume	Equiv- alent in standing timber	Value	Used volume	Equiv- alent in standing timber	Value	Used volume	Equiv- alent in standing timber	Value
	M ft. B.M.	M cu. ft.			M Pcs.	M Cu. ft.										
			M ft. B.M.	M cu. ft.			M Pcs.	M Cu. ft.	Cords	M. Cu ft.	M Cu. ft.	M Cu. ft.				
Eastern Provinces—																
Prince Edwd. Id.	3,542	295	776	86,692	527	7	2,432	4,460	37	98	12,662				339	874
Nova Scotia.....	101,624	8,468	22,256	2,231,431	59,920	829	279,804	13,912	116	306	41,726	105,532	9,498	12,347	18,911	34,909
New Brunswick..	406,744	33,895	89,076	10,635,970	427,641	5,914	2,240,016	207,484	1,729	4,564	670,031	399,126	35,921	46,698	77,459	140,338
Quebec.....	600,898	50,075	131,597	16,454,202	254,513	3,520	1,249,601	349,047	2,909	7,679	960,738	2,353,952	211,856	275,412	268,360	414,688
Ontario.....	893,565	74,464	195,691	29,214,216	297,405	4,113	1,675,316	30,221	252	665	112,162	1,618,252	145,643	189,336	224,472	385,692
Total.....	2,006,373	167,197	439,396	58,622,561	1,040,006	14,383	5,447,219	605,124	5,043	13,312	1,797,319	4,476,862	402,918	523,793	589,541	976,501
Prairie Provinces—																
Manitoba.....	72,013	6,001	15,771	1,793,303	26,173	362	159,602	2			10	3,065	276	359	6,639	16,130
Saskatchewan...	12,928	1,078	2,831	293,754	3,680	51	12,645								1,129	2,831
Alberta.....	41,010	3,417	8,981	942,827	7,023	97	33,435	209	2	5	665				3,516	8,986
Total.....	125,951	10,496	27,583	3,029,884	36,876	510	205,682	211	2	5	675	3,065	276	359	11,284	27,947
British Columbia..	1,631,686	135,974	357,339	37,964,779	127,579	1,765	533,761	2,356,819	19,640	51,850	8,621,402	307,987	27,719	36,034	185,098	445,223
Total (Canada)....	3,764,010	313,667	824,318	99,617,224	1,204,461	16,658	6,186,662	2,962,154	24,685	65,167	10,419,396	4,787,914	430,913	560,186	785,923	1,449,671

Factors Used for Converting Various Units of Measurement of Wood to Cubic Feet

Product	Unit in use in Canada	Volume used	Equivalent in standing timber
		Cubic feet	Cubic feet
Sawn lumber.....	1,000 ft. B.M.	83.33	219
Logs.....	1,000 "	83.33	219
Shingles.....	1,000 pieces	8.33	22
Lath.....	1,000 "	13.83	36.3
Pulpwood.....	1 cord	90.00	117
Fuel-wood.....	1 "	90.00	95
Distillation wood.....	1 "	90.00	123
Railway ties (hewed).....	1 piece	3.00	12
Poles.....	1 "	10.00	13
Piling.....	1 "	10.00	13
Fence-posts.....	1 "	1.50	2

13—Exports and Imports of Timber and Minor Forest Products

In the export trade of Canada, forest products rank second only to agricultural products in value. During the years 1922–1926, the value of the exports of forest products averaged \$258,329,281, and that of the imports only \$28,075,575, leaving a favourable average balance of \$230,253,706. This trade was distributed as follows:—

	Exports	Imports
	\$	\$
United Kingdom.....	18,296,885	1,494,651
United States.....	219,664,624	25,035,773
Other countries.....	20,367,772	1,545,151
	258,329,281	28,075,575

The surplus of \$194,628,851 in the trade with the United States has been a most important factor in stabilizing the monetary exchange between the two countries.

In order to show the true value of the forests in the external trade of Canada, all of the products which are essentially wood products should be included, even though a considerable proportion of the value of some of these products represents the value of the labour employed in their manufacture. Products such as agricultural implements and printed matter, though composed partly of wood, are not considered primarily forest products and are, therefore, not included.

Statistics are not available as to the species of wood exported or imported, but the principal woods exported are undoubtedly spruce, Douglas fir, white pine, western (red) cedar, and hemlock. The imports are chiefly of hardwood and high-grade paper. The quantities are not recorded for many of the manufactured products, so it is impossible to state accurately the total quantities of wood; these quantities have been estimated where not given in the Customs returns.

The increase in the value of exports and the importance of pulp and paper are shown in Table VI (A).

TABLE VI—AVERAGE ANNUAL EXPORTS AND IMPORTS, 1922–1926

- (1) Timber, Wood Manufactures, Wood-Pulp
- (2) Minor Forest Produce

	Exports		Imports		Balance, plus (+) or minus (—)	
	Value	Quantity	Value	Quantity	Value (col. 1— col. 4)	Quantity
		Equivalent in standing timber		Equivalent in standing timber		Equivalent in standing timber (col. 3—col. 6)
	(1)	(3)	(4)	(6)	(7)	(9)
		Million		Million		Million
Conifers.....		cu. ft. 1,160	.....	cu. ft. 53	.....	cu. ft. 1,107
Broad-leaved.....		48 (a)	.....	23 (a)	.....	25 (a)
Total.....	258,329,281	1,208	28,075,575	76	230,253,706	1,132

(a) Estimated.

TABLE VI (A)—AVERAGE ANNUAL EXPORTS AND IMPORTS, 1922-1926

	Exports			Imports			Balance Plus (+) or Minus (-)		
	Commer- cial units	Equiv- alent in standing timber	Value	Commer- cial units	Equiv- alent in standing timber	Value	Commer- cial units	Equiv- alent in standing timber	Value
		1,000 cu. ft.	\$		1,000 cu. ft.	\$		1,000 cu. ft.	\$
<i>Logs, sawn lumber, and other unmanu- factured and partly manufactured wood—</i>									
Lumber..... M ft. b.m.	2,146,455	470,074	65,060,050	150,068	32,865	8,169,382	+ 1,996,387	+ 437,209	+56,890,668
Lath..... M pcs.	1,665,409	30,227	9,395,775	1,266	45	9,270	+ 1,664,143	+ 30,182	+ 9,386,505
Shingles..... "	2,536,932	55,813	9,464,472	14,502	319	46,238	+ 2,522,430	+ 55,494	+ 9,418,234
Logs..... M ft. b.m.	278,701	61,036	4,764,270	8,605	1,884	257,964	+ 270,096	+ 59,152	+ 4,506,306
Square timber..... "	107,757	23,599	2,824,254	1,292	283	77,168	+ 106,465	+ 23,316	+ 2,747,086
Pulpwood..... cords	1,308,210	153,060	13,131,358				+ 1,308,210	+ 153,060	+13,131,358
Railway ties..... No.	1,283,489	15,402	992,399	597,870	7,174	743,315	+ 685,619	+ 8,228	+ 249,084
Poles..... "	577,951	7,513	2,537,659	9,242	120	58,828	+ 568,709	+ 7,393	+ 2,478,831
Piling..... lin. ft.	2,539,791	833	229,112				+ 2,539,791	+ 833	+ 229,112
Posts..... No.	886,762	1,774	88,423	125,992	252	17,325	+ 760,770	+ 1,522	+ 71,098
Fuel-wood..... cords	15,923	1,513	99,900	7,182	682	32,788	+ 8,741	+ 831	+ 67,112
Veneer.....		366	334,238		361	504,697		+ 5	+ 170,459
Bamboo, cane, reed, etc.						288,785			+ 288,785
Miscellaneous..... cords		14,000	2,393,243		2,776	474,544		+ 11,224	+ 1,918,699
Totals.....		835,210	111,315,153		46,761	10,680,304		+ 788,449	+100,634,849
<i>Manufactured wood—</i>									
Furniture, caskets, etc.			326,136			1,487,560			- 1,161,424
Handles, turned and curved wood.			119,761			827,166			- 707,405
Doors and sash, mouldings.			215,599			523,374			- 307,775
Cooperage.....			112,063			748,593			- 636,530
Cork, manufactures of						567,634			- 567,634
Miscellaneous.....			1,398,319			2,707,182			- 1,308,863
Totals.....		1,586	2,171,878		5,009	6,861,509		3,423	- 4,689,631
<i>Wood-pulp—</i>									
Sulphite, bleached..... tons	171,866	39,197	13,545,777	3,742	853	203,865	+ 168,124	+ 38,344	+13,341,912
Sulphite, unbleached..... "	235,427	53,694	12,607,805	14,323	3,267	789,357	+ 221,104	+ 50,427	+11,818,448
Sulphate (Kraft)..... "	150,544	29,627	9,310,981	23	4	1,040	+ 150,521	+ 29,623	+ 9,309,941
Mechanically ground..... "	330,370	38,595	10,200,905				+ 330,370	+ 38,595	+10,200,905
Mechanically and chemio- ally prepared..... "				3,267	569	169,233	- 3,267	- 569	169,233
Totals.....	888,207	161,113	45,665,468	21,355	4,693	1,163,495	866,852	156,420	+44,501,973
<i>Paper, except printed matter—</i>									
Newsprint and printing..... tons	1,297,617	189,776	91,839,238	3,070	448	609,152	+ 1,294,547	+ 189,328	+91,230,086
Writing and stationery..... "									
Packing and wrapping..... "									
Bags, boxes, cartons.....									
Board.....		19,850	7,337,544		18,731	8,761,115		1,119	- 1,423,571
Wall.....									
Building.....									
Tissue.....									
Miscellaneous.....									
Totals.....		209,626	99,176,782		19,179	9,370,267		+ 190,447	+89,806,515
Grand total.....		1,207,535	258,329,281		75,642	28,075,575		+ 1,131,893	+230,253,706

TABLE VI (B)—VALUE OF EXPORTS OF FOREST PRODUCTS

(Fiscal Years ending March 31, 1908-1927)

Year	Raw material	Poles, posts, ties, piling, etc.	Sawmill and planing- mill products	Manu- factured wood	Wood- pulp	Paper except printed matter	Total exports of forest products
	\$	\$	\$	\$	\$	\$	\$
1908.....	7,021,032	1,196,648	35,674,488	1,150,522	4,037,852	3,531,489	52,612,031
1909.....	6,703,977	532,015	32,289,608	824,508	4,306,929	3,487,600	48,144,637
1910.....	8,309,400	708,399	38,395,997	903,749	5,204,597	3,163,842	56,685,984
1911.....	8,611,366	691,648	36,031,040	955,655	5,715,532	3,924,375	55,929,616
1912.....	7,901,174	604,113	32,281,130	959,900	5,094,305	3,881,063	50,721,685
5-years' average.....	7,709,389	746,565	34,934,453	958,867	4,871,843	3,597,674	52,818,791
1913.....	9,345,610	471,594	33,375,382	917,063	5,509,544	6,397,820	56,017,013
1914.....	8,892,039	605,416	33,202,627	923,580	6,364,824	12,754,107	62,742,593
1915.....	8,809,396	664,965	33,139,762	789,306	9,266,161	15,573,362	68,242,952
1916.....	7,520,308	453,757	43,267,263	1,082,964	10,376,548	20,114,129	82,814,969
1917.....	7,910,857	614,590	47,409,468	838,751	20,404,053	26,231,761	103,409,480
5-years' average.....	8,495,642	562,064	38,078,900	910,333	10,384,226	16,214,236	74,645,401
1918.....	9,799,695	586,651	41,451,880	831,481	25,620,892	37,723,251	116,013,850
1919.....	17,532,313	737,089	52,181,259	1,140,306	34,706,771	47,862,909	154,160,647
1920.....	13,397,651	1,688,528	90,894,253	2,693,293	41,383,482	63,253,419	213,310,626
1921.....	25,966,273	4,340,821	85,953,497	3,704,334	71,552,037	92,103,307	283,620,269
1922.....	15,352,774	2,073,274	54,079,037	2,340,006	35,924,877	69,533,418	179,303,386
5-years' average.....	16,409,741	1,885,273	64,911,985	2,141,884	41,837,612	62,095,261	189,281,756
1923.....	16,678,552	2,272,866	84,556,761	2,046,638	42,976,948	79,567,941	228,099,706
1924.....	26,007,579	3,793,136	97,145,347	2,378,037	46,173,796	96,957,962	272,455,857
1925.....	22,455,767	4,484,053	82,154,130	1,977,993	41,565,241	99,941,910	252,579,094
1926.....	21,670,094	4,667,342	89,192,886	2,163,379	49,909,870	110,104,929	277,708,500
1927.....	23,995,728	4,952,579	78,907,123	2,127,029	49,887,739	123,222,734	283,092,932
5-years' average.....	22,161,544	4,033,995	86,391,250	2,138,615	46,102,719	101,959,095	262,787,218

TABLE VI—VALUE OF IMPORTS OF FOREST PRODUCTS
(Fiscal Years ending March 31, 1908–1927)

Year	Raw material	Poles, posts, ties, piling, etc.	Sawmill and planing mill products	Manufactured wood	Wood-pulp	Paper except printed matter	Total exports of forest products
	\$	\$	\$	\$	\$	\$	\$
1908.....	1,489,414	728,291	7,785,314	3,180,497	58,557	4,068,520	17,310,593
1909.....	1,078,808	769,497	4,484,671	2,411,014	35,252	3,656,279	12,435,521
1910.....	1,256,393	752,996	6,257,093	3,167,040	35,191	4,658,714	16,127,427
1911.....	1,839,134	1,275,727	9,887,720	4,192,982	53,197	5,533,402	22,782,162
1912.....	2,166,493	1,223,453	11,917,310	5,225,192	90,301	6,361,299	26,984,048
5-Years' Average.....	1,566,048	949,993	8,066,422	3,635,345	54,499	4,855,643	19,127,950
1913.....	2,903,780	2,006,388	15,231,867	8,046,468	270,608	8,347,314	36,806,425
1914.....	2,029,038	2,416,779	12,303,372	7,443,191	321,470	7,862,833	32,376,683
1915.....	1,600,943	1,318,993	6,762,337	4,332,339	480,481	5,763,884	20,258,977
1916.....	1,001,930	691,330	3,732,672	2,789,741	406,749	4,723,873	13,346,295
1917.....	1,400,734	924,529	4,747,158	3,766,029	651,311	6,848,300	18,338,061
5-Years' Average.....	1,787,285	1,471,604	8,555,481	5,275,513	426,124	6,709,241	24,225,288
1918.....	1,575,683	1,057,109	7,267,803	3,082,583	741,027	7,445,117	21,169,322
1919.....	2,115,515	1,658,634	9,703,962	3,742,811	795,603	8,886,393	26,902,918
1920.....	1,807,748	1,532,357	11,120,700	6,484,294	1,060,576	9,936,778	31,942,453
1921.....	2,439,864	2,069,813	14,476,941	8,102,864	3,148,046	13,645,321	43,882,849
1922.....	1,097,530	1,911,810	6,073,571	5,225,988	1,371,808	7,949,428	23,630,135
5-Years' Average.....	1,807,268	1,645,945	9,728,595	5,327,708	1,423,412	9,572,607	29,505,535
1923.....	1,126,344	676,776	8,239,345	5,481,027	1,338,865	8,481,676	25,344,033
1924.....	1,753,700	1,176,580	9,708,774	5,878,975	1,394,859	9,384,620	29,297,508
1925.....	1,305,215	829,546	7,555,681	5,842,572	1,762,264	9,095,066	26,390,344
1926.....	871,844	946,662	8,655,186	7,219,499	1,157,362	9,403,738	28,254,291
1927.....	1,689,672	589,469	10,824,968	8,499,950	1,257,635	11,359,582	34,221,276
5-Years' Average.....	1,349,355	843,807	8,996,791	6,584,405	1,382,197	9,544,936	28,701,491

14—Summary and Outlook

A—HOME CONSUMPTION OF HOME-GROWN AND IMPORTED TIMBER COMPARED WITH THE TOTAL INCREMENT

TABLE VII—SUMMARY STATEMENT
(Expressed as Standing Timber)

—	Utilization (Table IV, Cols. 3 & 7)	Exports (Table VI, col. 3)	Con- sumption of home- grown timber (Col. 1, minus col. 2)	Imports (Table VI, col. 6)	Total con- sumption of home and imported timber (col. 3 plus col. 4)	Net Increment (Table III, cols. 5 & 10)	Balance plus (+) or minus (—) (Col. 6, minus col. 5)
	(1) Million cu. ft.	(2) Million cu. ft.	(3) Million cu. ft.	(4) Million cu. ft.	(5) Million cu. ft.	(6) Million cu. ft.	(7) Million cu. ft.
Conifers.....	1,860	1,160	700	53	753		
Broad-leaved.....	848	48	800	23	823		
Total.....	2,708	1,208	1,500	76	1,576	Not available.	

As pointed out in Section 11, there are no reliable data on which to place an estimate of the amount of increment. Most of the merchantable timber is in virgin stands in which decay offsets the growth, and the reproduction and young stands following cutting and fire are, on account of the inflammable debris on the ground, especially exposed to destruction by fires. Rates of growth vary greatly in different parts of the Dominion, and, even if these were determined, the uncertainty of the fire-hazard in the present stage of forestry in Canada would preclude more than the expression of opinion as to the net annual increment. It has been estimated that in British Columbia twenty-two times as much timber has been destroyed by fire as has been cut for use, and, if the facts were known, they would show that similar conditions prevail in other provinces.

Though the loss of merchantable timber has been very greatly reduced in recent years as a result of the organization of forest-protective services, it still constitutes a serious drain on the forest resources. The annual consumption of standing timber for use amounts to about 2,708,000,000 cubic feet. At a very low estimate, fire destroys annually about 900,000,000 cubic feet of merchantable timber and the young growth on 1,300,000 acres. The loss due to insects and fungi is not known, but is estimated to amount to 800,000,000 cubic feet. It may be safely estimated that the forests of Canada are being depleted at the rate of upwards of 4,400,000,000

cubic feet per annum. With about 665,880 square miles of timber in a growing condition, an average increment of 10 to 11 cubic feet per acre would supply this amount, but in view of the destruction of young growth which occurs and the deterioration of the forests and of the soil, caused by repeated fires, there is little ground for hope that this increment is being produced.

Statistics as to the quantity of wood and wood-products exported and imported are incomplete, and the total can only be estimated. The figures in Table VII must therefore be taken as approximate only.

B.—PROBABLE DURATION OF SUPPLIES

The supply of readily accessible virgin timber is being depleted rapidly in Canada, as is evidenced by the greatly increased distances which the raw material is being transported to the manufacturing centres and by the extension of operations into territory which a few years ago was considered economically inaccessible. This has naturally enhanced the cost of logging. An increasing amount of "second growth" is being utilized every year, especially in pulpwood operations, following the extraction of saw-timber. This utilization of "second growth" and the extension of operations to more remote regions will prolong the life of the virgin timber for many years.

Though the quantity of timber used in the lumber industry has not been increased appreciably in the last decade, the consumption of pulpwood has doubled and the use of fuel-wood, ties, poles, and similar products continues to increase with the growth in population and the development of the country. Canada is now exporting annually to the United States the equivalent of over 1,000 million cubic feet, and there is every reason to expect an increasing demand on the forests of Canada to supply the growing needs of that country, especially for pulp and paper.

In a report to the United States Senate, the Secretary of Agriculture said, "Three-fifths of the original timber of the United States is gone and we are using timber four times as fast as we are growing it. The forests remaining are so localized as greatly to reduce their national utility. The bulk of the population and manufacturing industries of the United States are dependent upon distant supplies of timber as a result of the depletion of the principal forest areas east of the Great Plains."

In 1917, Canada supplied in pulpwood, pulp, and paper, thirty per cent of the paper consumption of the United States, and in 1926 the percentage had increased to forty-one, amounting to the equivalent of 5,337,000 cords. The domestic production of pulpwood in the United States was only 5,149,000 cords, and other countries supplied the equivalent of 1,498,000 cords. With the growth of population and decreasing supplies of timber in the United States, it must be expected that an increased demand for Canada's forest products will result, and this Dominion should be in a position to take advantage of this expanding and profitable market at its doors.

Canada is the principal source of coniferous timber within the British Empire, and her exports to other parts of the Empire and to the Orient and South America are rapidly increasing. With the growth of population in the Dominion, the needs for home consumption are bound to be greater, for, in spite of the use of substitutes, the use of wood continues to increase.

Though there is sufficient timber in Canada to maintain the present cut for many years, if all of it were exploitable, there is every reason to believe that the forest capital is being rapidly depleted, and if the increased demand is to be met, or even the present output maintained, and the forests of Canada placed on a sound basis of management, provision should be made without delay for the securing of sufficient net increment to meet the future requirements. The long time required for the growth of a merchantable stand of timber demands adoption of a forest policy far in advance of the immediate necessities.

C—STEPS WHICH SHOULD BE TAKEN TO PROTECT AND DEVELOP THE FORESTS

There is very urgent need in Canada for the adoption of a national forest policy, which will harmonize, in so far as it is possible, the administration of the forests throughout the Dominion. This can be accomplished only through the concerted action of the Dominion and Provincial forest authorities meeting in conference. No great improvement in the methods of handling the forest can be secured from localized action, since restrictions or regulations which place the operators of one region at a present disadvantage as compared with their competitors in other parts of a country cannot be expected to receive the popular support necessary for their successful operation.

Such a national forestry policy should include:—

1. The dedication of absolute forest land to the permanent production of timber. This involves the classification of the land and the exclusion of settlement from lands which are essentially suitable for forest purposes.

2. Legislation and organization sufficient to ensure adequate forest-fire protection. This involves

- (a) a campaign of education to secure fire prevention;
- (b) the proper disposal of slash;
- (c) standardized equipment for the detection and suppression of fires.

3. The employment of cutting regulations designed to secure the most favourable conditions for the reproduction and growth of the more valuable species of trees.

4. The encouragement of the practice of forestry on private lands by the proper adjustment of taxation to meet the special needs of forest property and by furnishing advice and assistance in the establishment and care of the forests.

5. It is of the utmost importance that a complete inventory of the forest resources be secured at as early a date as possible in order that the Governments and the public at large may be fully informed as to the extent to which these resources have been depleted, and what the prospects are for future supplies, and also that the industries dependent on the forest may be guided in their development by a knowledge of the location and extent of both present and future sources of raw material.

6. In order that the forests may be handled in such a manner as to secure the highest sustained production, there is a great need for a definite knowledge of the silvicultural characteristics and requirements of Canadian forests. This knowledge can be secured only by painstaking research.

APPENDICES

A—LIST OF REPORTS OF COMMISSIONS AND COMMITTEES REPORTING ON FORESTRY AND FOREST QUESTIONS

- Forestry Commissioner (J. H. Morgan) to Minister of the Interior, 1884
 Royal Commission on Forest Protection in Ontario, 1897
 Royal Commission on Timber and Forestry, British Columbia, 1909-10
 Forestry Commission of Prince Edward Island, 1904
 Commission of Conservation (appointed as a result of the North American Conference on Conservation, February, 1909; discontinued, 1920)
 Annual Reports, 1910-19
 Forest Conditions of Nova Scotia
 Conditions in the Clay Belt of New Ontario
 Forest Protection in Canada (1912-13)
 Trent Watershed Survey
 Forest Protection in Canada (1913-14)
 Wood Fuel to Relieve the Coal Shortage in Eastern Canada
 Forests of British Columbia
 Royal Commission on Pulpwood, 1923.

B—LIST OF LEGISLATIVE ENACTMENTS DEALING WITH FORESTRY AND FORESTRY QUESTIONS

- Dominion Forest Reserves and Parks Act, Dominion Lands Act, Railway Act
 British Columbia Forest Act, British Columbia Land Act, Taxation Act
 Ontario Forest Reserves Act, Crown Timber Act, Forestry Act, Forest Fires Prevention Act, Fires Extinguishment Act, Fire Guardians Act, Provincial Parks Act, Counties Reforestation Act, Mills Licensing Act, Timber Cutting Regulation Act
 Quebec Lands and Forests Act, Forest Research Promotion Act
 New Brunswick Forest Act, Scalpers Act, Forest Service Act, Forest Fires Act
 Nova Scotia Lands and Forests Act
 Forest Fires Acts of the provinces of Manitoba, Saskatchewan and Alberta.

C.—LIST OF PUBLICATIONS ISSUED BY OR UNDER THE SUPERVISION OF THE FORESTRY AUTHORITY

Publications of the Forest Service, Department of the Interior, Ottawa. (See accompanying list.)

Publications of the Dominion Bureau of Statistics, Department of Trade and Commerce (Annual Statistical Bulletins on Forest Products).

Annual reports of the Timber and Grazing Branch, the Commissioner of Dominion Parks, and the Dominion Board of Railway Commissioners.

Annual Reports of the Provincial Departments administering timber-lands in British Columbia, Ontario, Quebec, New Brunswick, and Nova Scotia.

Publications of the Forest Services in British Columbia, Ontario, Quebec, and New Brunswick.

DOMINION FOREST SERVICE PUBLICATIONS AVAILABLE FOR DISTRIBUTIONS

Annual Reports of the Director of Forestry, 1917-18-19-21-22-23-24-25-26-27.

- Bulletin 1 Tree-planting on the Prairies.
 " 49 Treated Wood-block Paving.
 " 51 Game Preservation in the Rocky Mountains Forest Reserve.
 " 53 Timber Conditions in the Smoky River Valley and Grande Prairie Country.
 " 59 Canadian Woods for Structural Timbers.
 " 61 Native Trees of Canada.
 " 66 Utilization of Waste Sulphite Liquor.
 " 67 Creosote Treatment of Jack Pine and Eastern Hemlock for Cross-ties.
 " 69 The Care of the Woodlot.
 " 71 Canadian Sitka Spruce: Its Mechanical and Physical Properties.
 " 73 Tree-Repairing.
 " 74 Distillation of Hardwoods in Canada.
 " 75 Wood-using Industries of Ontario.
 " 76 Pulping Qualities of Fire-killed Wood.
 " 77 Statistical Methods in Forest-investigative Work.
 " 78 Some Commercial Softwoods of British Columbia.
 " 79 Taper as a Factor in the Measurement of Standing Timber.

- Circular 9 Chemical Methods for Utilizing Wood Wastes.
 " 12 The Empire Timber Exhibition.
 " 13 The Casara Tree in British Columbia
 " 14 Commercial Forest Trees of Canada.
 " 16 Preservative Treatment of Fence-posts.
 " 17 Forest-investigative Work of the Dominion Forest Service.
 " 18 The Kiln-drying of British Columbia Softwoods.
 " 19 Canadian Softwoods.
 " 20 List of Form-class and Miscellaneous Volume Tables.
 " 21 Tests of Green-cut Western Cedar Poles.
 " 22 Report on Tests of the Relative Strength of Green-cut and Fire-killed Western Cedar Pole Timber.

Tree Pamphlet	1	White Pine.
"	"	2 White Spruce.
"	"	3 Douglas Fir.
"	"	4 Hemlock (Eastern).
"	"	5 Western Hemlock.
"	"	6 Red Pine.
"	"	7 Jack Pine.
"	"	8 Lodgepole Pine.
"	"	9 Balsam Fir.
"	"	10 Cedar (Eastern).
"	"	11 Western Cedar.
"	"	12 Sitka Spruce.
"	"	13 Western Yellow Pine.

Forest Facts.

Stories and Plays for Children—

Talking Trees.

The Enchanted Study.

Betty in Dreamland.

The Woodland Fairy.

Bow River National Forest. Descriptive pamphlet with map.

Forestry Topic 1 Canada in Relation to the World's Timber Supply.

" " 2 Forest Fire Protection in Canada.

" " 3 Silviculture in Canada.

" " 4 The Need of a Definite Forestry Policy.

" " 5 Tree Planting for Ornamental Purposes.

Manual of Methods of Communication Adapted to Forest Protection.

Dominion Forestry Branch Message Code.

Forest Research Manual.

The Tree-planting Division: Its History and Work.

The Forests of Canada.

PERIODICALS AND MISCELLANEOUS LITERATURE BEARING ON FORESTRY

Canadian Forests and Outdoors. 1905. (Established, 1905, as Canadian Forestry Journal; name changed, 1920, to Canadian Forestry Magazine, and again, in 1923, to present title.) Published by the Canadian Forestry Association, Ottawa, Canada.

La Forêt et la Ferme. Published by the Canadian Forestry Association, Ottawa.

Forestry Chronicle. Published by the Canadian Society of Forest Engineers at Toronto, Ont.

Pulp and Paper Magazine. Official organ of the Technical Section of the Canadian Pulp and Paper Association. Gardenvale, Que.

Canada Lumberman. Toronto, Ont.

Western Lumberman. Vancouver, B.C.

British Columbia Lumberman. Vancouver, B.C.

La Vie forestiere et rurale. 1922-23.

Reports of the Canadian Forestry Association (1900-1913).

Reports of the Canadian Forestry Conventions of 1906 and 1911.

Report of New Brunswick Forestry Convention, 1907.